SHARP®

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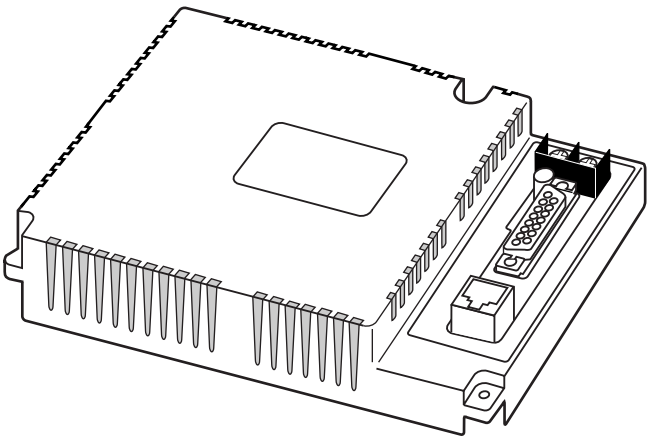
LCD control terminal

Module name

Network Module ZM-80NU

User's Manual



Thank you for purchasing the ZM-80NU network module for the ZM-43/52/72/82 series LCD control terminal.
This manual describes the installation and use of the ZM-80NU.
Make sure to read this manual thoroughly in order to fully understand its functions.
The following manuals are available for the ZM-43/52/72/82 series. Use them together with this manual.

- ZM-80NU ——— User's Manual (This manual)
- ZM-42/43/52/72/82 ——— User's Manual
- ZM-71SE ——— Instruction Manual
  (Screen edit software: English) ——— User's Manual (Tutrial)

Note

- Should you have any questions or inquires, please feel free to contact one of our dealers, or our service department.
- Copying this manual in part of in total is prohibited.
- The contents of this manual may be revised without notice.

Safety Precautions

Read this manual and attached documents carefully before installation, operation, maintenance and checking in order to use the machine correctly. Understand all of the machine knowledge, safety information, and cautions before starting to use. In this instruction manual, safety precautions are ranked into "danger" and "caution" as follows.

Danger : Wrong handling may possibly lead to death or heavy injury.

Caution : Wrong handling may possibly lead to medium or light injury.

Even in the case of **Caution**, a serious result may be experienced depending on the circumstances. Anyway, important points are mentioned. Be sure to observe them strictly.

(1) Installation

Caution

- Use in the environments specified in the user's manual.
  Electric shock, fire or malfunction may be caused when used in the environments of high temperature, high humidity, dusty or corrosive atmosphere, vibration or impact.
- Install according to the user's manual.
  Wrong installation may cause drop, breakdown, or malfunction.
- Never admit wire chips or foreign matters.
  Or fire, breakdown or malfunction may be caused.

(2) Wiring

Caution

- Wiring should be done by qualified electrician.
  Wrong wiring may lead to fire, breakdown or electric shock.

(3) Use

Danger

- Don't touch the terminal while the power is being supplied or you may have an electric shock.
- Assemble the emergency stop circuit and interlock circuit outside of the programmable controller. Otherwise breakdown or accident damage of the machine may be caused by the trouble of the programmable controller.

(4) Maintenance

Prohibit

- Don't disassemble or modify the modules.
  Or fire, breakdown or malfunction may be caused.

Chapter 1: Outline (Ethernet/FL-net)

Chapter 2: Specifications (Ethernet/FL-net)

Chapter 3: Names of parts and functions, Installation, wiring (Ethernet/FL-net)

Ethernet (Chapter 4 to 9)

Chapter 4: System setting

Chapter 5: Editing network tabel

Chapter 6: Macro

Chapter 7: System memory

Chapter 8: Transferring screen data

Chapter 9: Error display

FL-net (Chapter 10 to 15)

Chapter 10: FL-net

Chapter 11: Create screen

Chapter 12: Macro

Chapter 13: System memory

Chapter 14: Troubleshooting

Chapter 15: Appendix

Index

Chapter 1: Outline (Ethernet/FL-net) 1-1

Ethernet 1-2

What FL-net is 1-4

Features of FL-net 1-5

■ Conforms to widely accepted standards 1-5

■ Supports necessary communication functions between controllers 1-5

■ Basic structure of FL-net protocol 1-6

■ Common questions about FL-net 1-6

Chapter 2: Specifications (Ethernet/FL-net) 2-1

Specifications of Ethernet communication 2-1

■ Performance specifications 2-1

Specifications of FL-net 2-3

■ Performance specifications 2-3

■ Support range of ZM-80NU 2-3

Chapter 3: Names of parts and function, installation, wiring (Ethernet/FL-net) 3-1

Names of parts and functions 3-1

Mounting ZM-80NU 3-3

External dimensions when mounted ZM-80NU 3-4

■ External dimensions of ZM-80NU 3-4

Wiring 3-5

In case of connecting by AUI 3-5

■ 10BASE5 3-5

■ Transceiver 3-5

■ 10BASE2 3-6

■ Transceiver 3-6

In case of connecting by 10BASE-T 3-7

■ When HUB is used 3-7

■ Cable 3-7

Ethernet (Chapter 4 to 9)

Chapter 4: System setting 4-1

Example of connection 4-1

(A) Connection by RS-232C or RS-485 4-2

(B) Connection to PC on Ethernet 4-3

Chapter 5: Editing network table 5-1

Network table 5-1

Start and quit software 5-2

Menu bar and icons 5-2

How to set network table 5-4

Chapter 6: Macro 6-1

Macro commands 6-1

■ EREAD 6-1

■ EWRITE 6-2

Chapter 7: System memory 7-1

■ List of addresses 7-1

■ Addresses 7-4

Chapter 8: Transferring screen data 8-1

How to transfer data 8-1

Notes 8-3

Setting procedure 8-3

Chapter 9: Error display 9-1

Communication error 9-1

Errors caused by execution of Macro commands 9-3

Check 9-4

FL-net (Chapter 10 to 15)

Chapter 10: FL-net 10-1

Description of FL-net 10-1

■ FL-net concept 10-1

■ FL-net protocol 10-2

■ Features of FL-net transfer system 10-2

■ FL-net's IP address 10-2

Number of nodes and node numbers on FL-net 10-3

Data communication type 10-3

■ Cyclic transfer 10-4

■ Message transfer 10-4

Transfer data volume 10-5

■ Cyclic transfer 10-5

■ Message transfer 10-5

Transfer cycle 10-5

Data area and memory 10-6

Communication management table 10-6

■ Local node management table 10-6

■ Participating node management table 10-7

■ Network management table 10-7

Cyclic transfer and data area 10-8

■ Outline of cyclic transfer process 10-8

■ Common memory 10-9

■ Common memory areas 1 and 2 10-10

■ Guarantee of simultaneity of data 10-11

Message transfers 10-12

■ Outline of message transfer process 10-12

■ Table of ZM-80NU support messages 10-12

Chapter 11: Create screen 11-1

System setting 11-1

■ Select PC type 11-1

■ Set FL-Net communication parameters 11-2
Memory setting 11-4
■ Common memory area (cyclic transfer) 11-4
◇ Absolute address assignment 11-4
◇ Incremental address assignment 11-5
■ Virtual memory area (message transfer) 11-5
Differences between "General-purpose FL-net" and "** (FL-net)" 11-6**

Chapter 12: Macro 12-1
Macro command 12-1
■ [GET_STATUS_FL] 12-1

Chapter 13: System memory 13-1
■ List 13-1
■ Description for addresses 13-2

Chapter 14: Troubleshooting 14-1
General precautions related to FL-net 14-1
Communication errors 14-2

Chapter 15: Appendix 15-1
Definition of network systems 15-1
■ Communication protocol standards 15-1
■ Physical implementations of FL-net 15-1
■ IP addresses on FL-net 15-1
■ FL-net sub net mask 15-2
■ TCP/IP, UDP/IP protocols 15-2
■ FL-net port number 15-3
■ FL-net data format 15-3
Network control of FL-net 15-5
■ Token control of FL-net 15-5

1 Outline (Ethernet/FL-net)

The ZM-80NU network module is used to connect a Z-43/52/72/82 series LCD control terminal to an Ethernet network. It supports the UDP/IP protocol. (The ZM-80NU cannot be used with the ZM-42 series.) When used as an FL-net communication module, it supports the FA link protocols including cyclic transfers and message transfers (word read/write).
To change between Ethernet and FL-net use, select the desired protocol using the ZM-71SE screen editor software.
(Ethernet ⇨ See pages 4-2 to 4-3, FL-net ⇨ See page 11-1)

The ZM-80NU consists of the following.

One ZM-80NU network module	
Accessories	- One securing spacer
	- One sheet of alert decal to prevent miss insertion
	- Three securing screws (M3 x 8)
	- One spacer screw (M3 x 15)
	- One spare fuse

Note: Use V1.2.0.0 or later of the ZM-71SE software with program (SYSTEM PROG.VER.) V1.200 for the ZM-43/52/72/82 series.

UDP/IP (User Datagram Protocol / Internet Protocol)

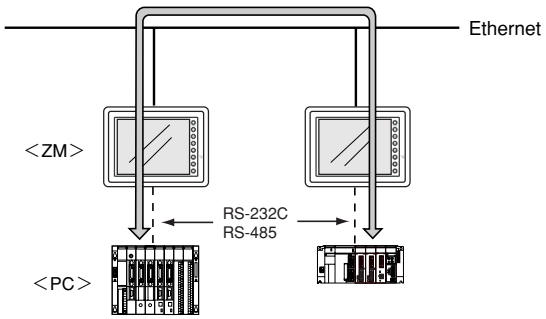
Data is sent by specifying the IP address of the target, as communication is performed without the setting of the connection to the other end.
Data can be sent at faster speed, however, there is no guarantee that the data will be properly delivered. Measures such as user applications should be taken to make the system more reliable.

Our ZM-80NU, is already ready for it, and no applications for the unit is required.

Ethernet

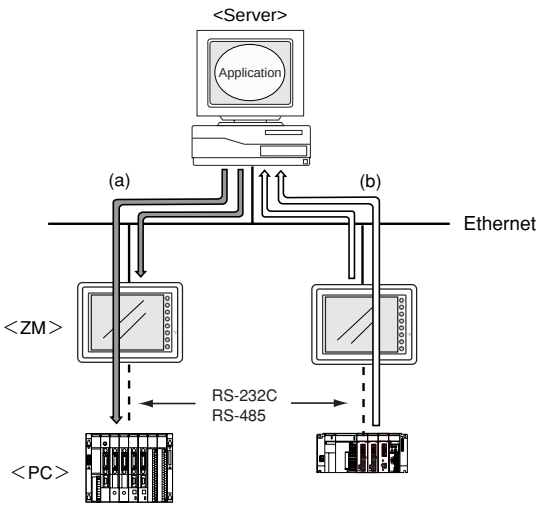
◎Transferring the contents of the memory devices

- The contents of the memory devices can be transferred to ZMs on an Ethernet, or PCs connected via ZMs by using the Macro commands (EREAD/EWRITE).



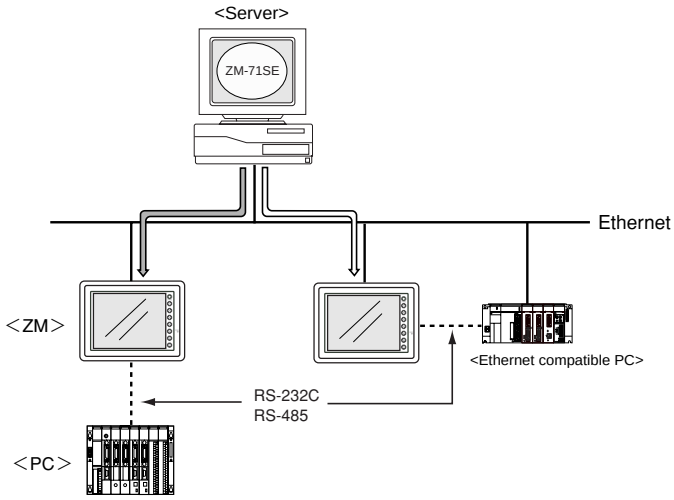
◎Communication between the server and the ZM

- HKEtn10.dll is provided to create the application by using VC++ or VB etc. to access to the memory devices such as ZM internal memories, memory card, memory devices of the PC which is connected via ZM. - - - - - (a)
- The Macro command (SEND) enables the ZM to access to the server. - - - - - (b)



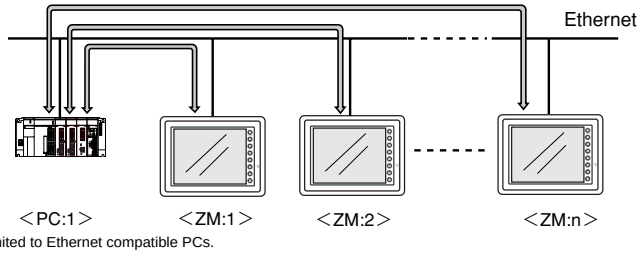
Contact our sales department to obtain the files mentioned above.

• Screen data can be transferred to the ZM using the ZM-71SE on the server.

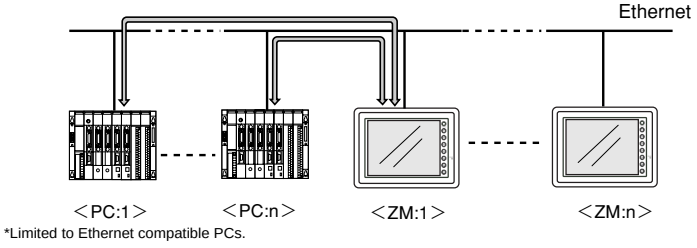


◎Communication between the PC that compatible with Ethernet and the ZM

• ZM can communicate with the PC which is connected through Ethernet.

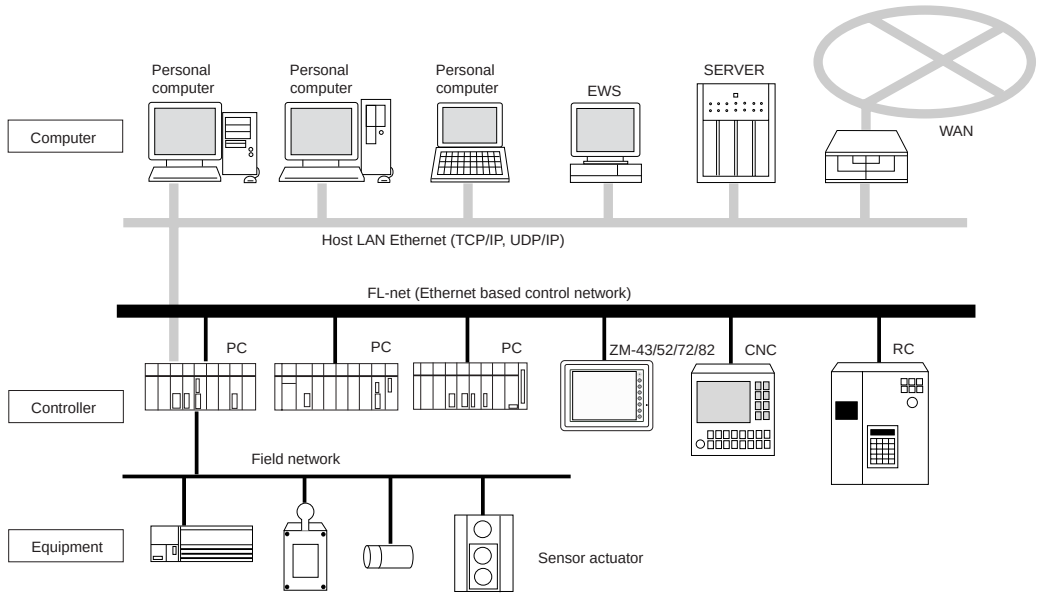


• Multiple PCs on the Ethernet can be accessed.



What FL-net is

The FL-net is an open factory automation network that was standardized by the FA Open Promotion Committee in the Manufacturers' Science Technology Center (MSTC), which is supported by the Japanese Ministry of Industry and Trade.
As shown in the figure below, the FL-net can interconnect various FA controllers, such as programmable controllers from different manufacturers and computer numeric controlled machines (CNC), as well as personal computers, to control and monitor an automated factory system.



Features of FL-net

◎Open network
◎Used by a variety of venders
◎Connects programmable controllers and CNCs from different manufacturers for control and monitoring.

■ Conforms to widely accepted standards

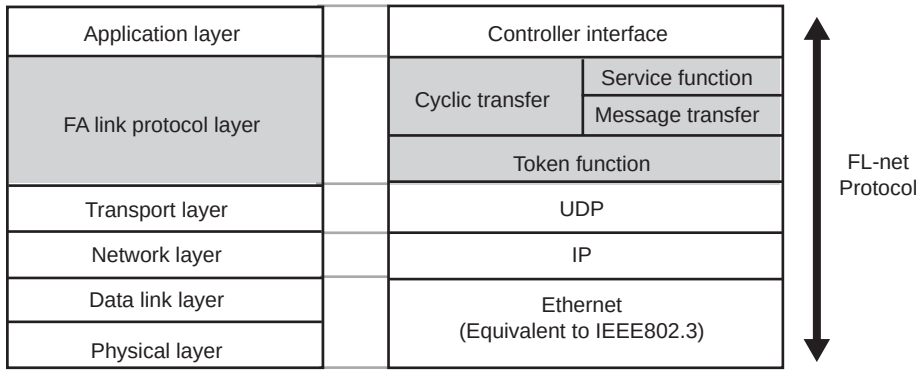
FL-net is based on the Ethernet protocol that is the standard for OA equipment. It establishes effective communication using identical standards.

- Low price
  Since an FL-net network can be constructed using readily available communication devices, a network can be created inexpensively.
- Readily available network devices
  Readily available Ethernet devices, such as transceivers, hubs, cables, and LAN cards for personal computers, can be used to construct an FL-net.
- Even higher speed in the future
  Data communication speed is expected to increase from 10 Mbps to 100 Mbps, and later to 1 Giga bps.
- Optical communication
  Using optical repeaters and other optical devices that to carry Ethernet traffic, all of the basic parts can be converted to optical fiber communications. This is effective in sending signals over long distances (more than 500 m) and in improving noise immunity. It also offers protection against lightning induced surges in outdoor wiring.

■ Supports necessary communication functions between controllers

- Large scale network
  Up to 254 devices (nodes) can be connected.
- Two types of communication functions are available to match the application
  The FL-net supports both a common memory function (the same data is always shared between nodes) and a message communication function (exchange required data only when needed).
- Large capacity common memory
  The common memory area has a large capacity of 8 K bits and 8 K words.
- High-speed response
  High-speed 50 ms response for 32 nodes (2 K bits + 2 K words) is possible.
- Highly reliable masterless system
  Since there is no master station, each node can participate freely and leave the network at any time without having a negative influence on any other node's communication. Therefore, any node can be freely turned ON/OFF for maintenance.

■ Basic structure of FL-net protocol



■ Common questions about FL-net

	Question	Answer
1.	What is the Ethernet?	The Ethernet is a specification defining communication cable types and communication protocols. It is used to construct local area networks (LAN). It can transfer data between personal computers at communication speeds 10 Mbps to 100 Mbps. The most common Ethernet application is in offices at 10 Mbps using twisted pair cable (UTP). An Ethernet network can be used to communicate among various devices by using software protocols supported by lots venders.
2.	What is the FL-net?	The FL-net is an Ethernet based network used to connect FA controllers (such as programmable controllers) and CNCs. It exchanges control data between the controllers at high speed. The same cables and devices used for the Ethernet can be used top construct an FL-net.
3.	What are the differences between the FL-net and the Ethernet?	The Ethernet, connects controllers such as a host computers and personal computers in order to exchange data and control equipment (including instructions for production) and to collect the resulting data. The FL-net, connect controllers in order to exchange control data at high speed. If you will be making an Ethernet connection for communication with a host computer and an FL-net connection for communication between controllers on one controller, be careful not to confuse the cables.
4.	How do you use an FL-net module?	Install an FL-net module in an FA controller, such as programmable controller, or in a CNC. Assign a station number (node number) and a link allocation setting for common memory (link register). Now the FL-net module can send and receive cyclic data between controllers. There is no need for a special communication program for a programmable controller or other devices. Also, there is no need for a special communication program to read and write to memory or to pass communication parameters between a personal computer and a programmable controller. However, each controller does need a program if you want to communicate between controllers by sending and receiving data using the message transfer function.
5.	What is a protocol?	A protocol is the rules used to communicate between devices. The FL-net supports UDP/IP and the "FA link protocol," a special FL-net protocol that is located in the upper layer of the UDP/IP.
6.	Can a normal personal computer be connected to the FL-net?	FL-net modules for installation in FA controllers such as programmable controllers and CNCs are intelligent units with a computer processor on their boards. Ethernet cards for personal computers are not intelligent and so are called dumb boards. We recommend using intelligent FL-net boards, depending on the performance of the personal computer and your application.

7.	What is topology?	Networking topology refers to the network wiring scheme. Primarily, there are three types: the star shape (tree shape), the bus shape, and the ring shape. These are logical wiring schemes rather than physical wiring schemes. The FL-net uses 10BASE-T and this is a star shape topology. 10BASE5 is a bus shape topology.
8.	Types and length of network cables, as well as the number of units that can be connected.	Shown below are a part of the standards, features, and limitations of ordinary Ethernet cable. Note: Numbers in parentheses ( ) are applicable when repeaters are used. 10BASE-T: Maximum transfer distance per segment of twisted pair cable (UTP); 100 m (500 m) 10BASE5: Maximum transfer distance per segment of thick coaxial cable (yellow cable); 500 m (2500 m). A maximum of 100 units can be connected to one segment. 10BASE-FL: Maximum transfer distance per segment of optical fiber cable; 2000 m. A maximum of 254 units can be connected to one segment.
9.	Is a special Ethernet specification required for an FL-net system?	No. There is no need for special specifications. To construct an FL-net system, you may use standard Ethernet equipment (equivalent to IEEE802.3 standards). There are no special specifications.
10.	How do you connect to an FL-net?	To connect different types of Ethernet cables, you can use a repeater or a media conversion adapter. These products are offered by various venders.
11.	Which cable should be used for constructing an FL-net system?	In general, use the following. - 10BASE5 (thick coaxial cable: yellow cable) for a trunk. - 10BASE-5 (twisted pair cable: UTP category 5) for inside a control panel or in an office. - 10BASE-FL (optical fiber cable) for locations with high voltage power sources or lots of electrical noise.
12.	How do you set an IP address on the FL-net?	An IP address on the FL-net consist of a network address (192.168.250) and a host number (node number: 1 to 254). However, node numbers 250 to 254 are reserved for maintenance use.
13.	How compatible and interconnectable are the various pieces of FL-net equipment?	There is a certification committee for the FL-net. It tests applications and the interconnection performance of devices. Tools and devices that pass these tests are given certificates of approval. They can be used with confidence in an FL-net system.

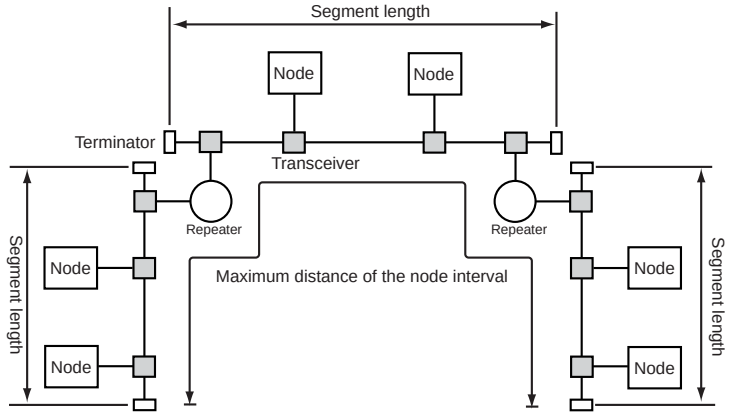
2 Specifications (Ethernet/FL-net)

Specifications of Ethernet communication

■ Performance specifications

Item	Specifications		
	AUI		10BASE-T
	10BASE5	10BASE2	
Baud rate	10 Mbps		
Communication method	Base band		
Maximum distance of the network or maximum node interval	2500 m (5 segments)	925 m (5 segments)	200 m (for 1 set of HUB)
Maximum segment length	500 m	185 m	100 m (between the node and the HUB)
Maximum number of the nodes	100 pcs/segment	30 pcs/segment	2 pcs/segment
Minimum node interval	2.5 m	0.5 m	None
Communication cable	Ethernet Coaxial cable (50 ohm)	RG58A/U, RG58C/U Coaxial cable (50 ohm)	UTP (Twisted pair cable without shields) 22-26AWG

< Example of the AUI >



◎ Glossary

- Node : Terminals on the Ethernet such as ZM-43/52/72/82, PC, server etc.
  Each terminal has an IP address.(*)
- Segment : A section which has terminators at both ends.
- Segment length : The distance between the terminators.
- Maximum distance of the node interval
  : The longest distance between the nodes on a network.
- Repeater : A device which is used for passing on a signal to connect one segment to another.

* For further information on the setting of the IP addresses, refer to P5-4.

Specifications of FL-net

■ Performance specifications

Item	Specifications		
	AUI		10BASE-T
	10BASE5	10BASE2	
Baud rate	10 Mbps		
Communication method	Base band		
Transfer protocol	FA link protocol		
Maximum distance of the network or maximum node interval	2500 m (5 segments)	925 m (5 segments)	500 m (4 set of HUB)
Maximum segment length	500 m	185 m	100 m (between the node and the HUB)
Maximum number of the nodes on a system	254 station (connection via router is not possible)		
Maximum number of the nodes	100 pcs/segment	30 pcs/segment	2 pcs/segment
Minimum node interval	2.5 m	0.5 m	None
Communication cable	Ethernet Coaxial cable (50 ohm)	RG58A/U, RG58C/U Coaxial cable (50 ohm)	UTP (Twisted pair cable without shields) 22-26AWG

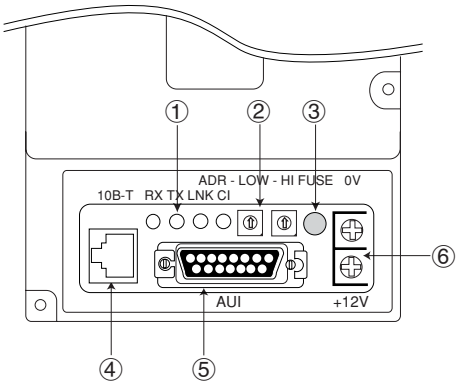
■ Support range of ZM-80NU

Function			Support	
			Request (Sending)	Response (Receive)
Data communication	Cyclic transfer	Area 1	○	○
		Area 2	○	○
	Message transfer	Read and write byte block	×	×
		Read and write word block	○	×
		Read network parameter	×	○
		Write network parameter	×	×
		Run and stop instructions	×	×
		Read profile	×	○
		Read communication log data	×	○
		Clear communication log data	×	○
		Return message	×	○
		Explicit message	×	×
Network control	This node control table		○	
	Participating node control table		○	
	Network control table		○	

The ZM-80NU does not have virtual memory area.
However, reading from, and writing to a virtual memory area located on other nodes in the network is also possible.

3 Names of parts and function, installation, wiring (Ethernet/FL-net)

Names of parts and functions



① LED

Indicates the status of the communication.

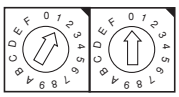
Name	Contents	On	Off
RX	Data receive status	Currently receiving	No receiving
TX	Data send status	Currently sending	No sending
LNK	Link status (for 10BASE-T only)	Normal	Error
CI	Collision	Data collision	Normal

② Port No. setting switches

The port No. of the ZM-43/52/72/82 specified in the Network Table is set by the lotaly switches.

< E.g. > The port No. is 1:

ADR - LOW - HI



- Make sure the port No. of each ZM-80NU on the same network is not duplicated.
- When delivered, these switches are set to LOW = 1 and HI = 0 (which assigns it to station number 1).

- When using the ZM-80NU in an FL-net, no setting is required. Use it without changing the settings.

③ Fuse

This is the fuse for supplying 12 VDC power source. (Rating 2A)
If the fuse blows, replace it with the fuse included as an accessory. Use a pair of tweezers to change the fuse.
Note: Make sure to turn off the power before replacing the fuse.

Item name	Model name	Mfg.
Fuse (type installed on a board)	TR3-F19303-2A	WICKMAN

④ 10BASE-T connector

This is the connector for connecting to the 10BASE-T.
(conform to IEEE802.3)
In order to prevent accidents that can be caused by misusing the 10BASE-T modular connector, observe the following carefully.

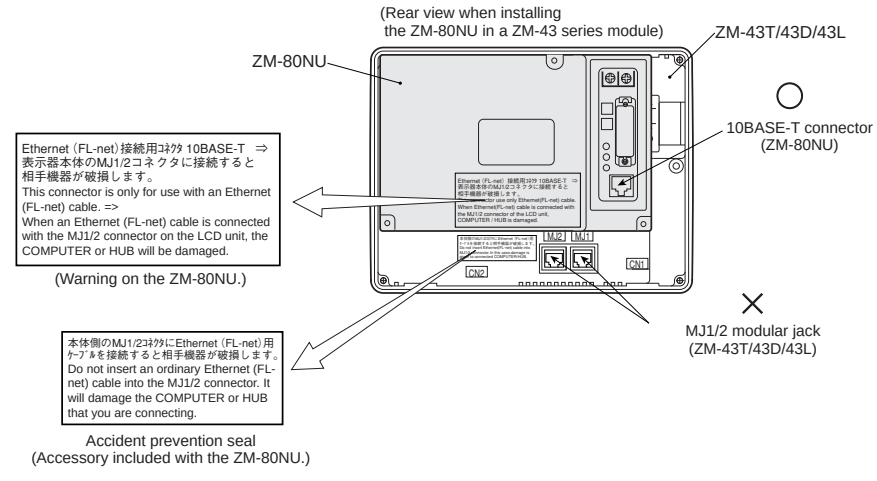
⑤ AUI connector

This is the connector for connecting the transceiver cable in case of using 10BASE2 or 10BASE5.

⑥ 12 VDC power source terminal

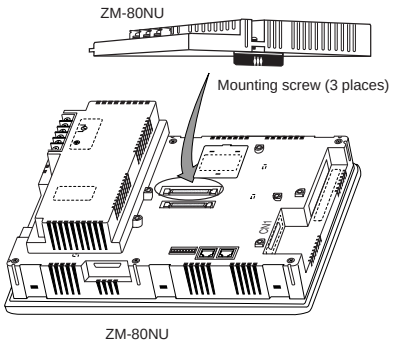
The power source is required in case of using AUI.
Voltage drop of the CU-03 (max. 0.7V) should be taken into account for supplying the power.

Never connect the 10BASE-T cable from a modular connector on a computer, hub, or programmable controller to the modular jack (MJ1/2) on the ZM-80NU. The computer, hub, or programmable controller may be damaged by excessive current.
Attach the "Accident prevention seal" (included as an accessory) near the MJ1/2 jack, to alert anyone plugging in cables.

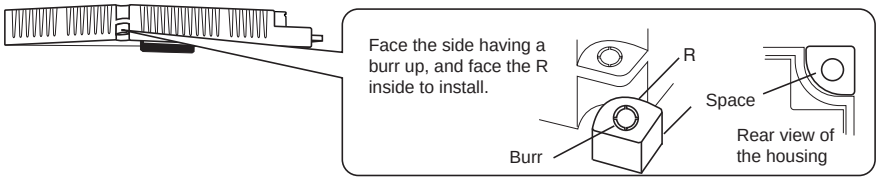

(Rear view when installing the ZM-80NU in a ZM-43 series module)
ZM-43T/43D/43L
ZM-80NU
10BASE-T connector (ZM-80NU)
Ethernet（FL-net）接続用ｺﾈｸﾀ 10BASE-T ⇒ 表示器本体のMJ1/2コネクタに接続すると相手機器が破損します。
This connector is only for use with an Ethernet (FL-net) cable. =>
When an Ethernet (FL-net) cable is connected with the MJ1/2 connector on the LCD unit, the COMPUTER or HUB will be damaged.
(Warning on the ZM-80NU.)
MJ2
MJ1
CN2
CN1
本体側のMJ1/2ｺﾈｸﾀにEthernet（FL-net）用ｹｰﾌﾞﾙを接続すると相手機器が破損します。
Do not insert an ordinary Ethernet (FL-net) cable into the MJ1/2 connector. It will damage the COMPUTER or HUB that you are connecting.
Accident prevention seal
(Accessory included with the ZM-80NU.)
MJ1/2 modular jack (ZM-43T/43D/43L)

Mounting ZM-80NU

1. Remove a dust protection seal being pasted behind a ZM, and mounting the ZM-80NU, then fix it with the mounting screws at 3 places with the mounting screws (M3x8) which is included in the ZM-80NU.
   (Tightening torque of the mounting screws: 3 to 5 kgf-cm)



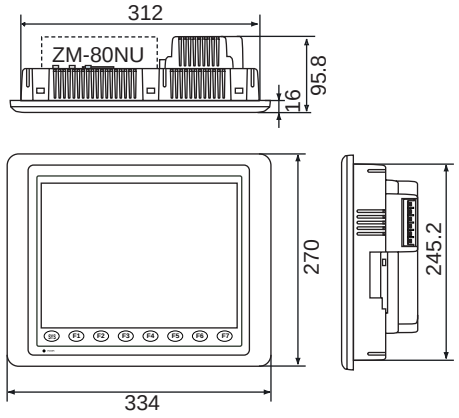
2. When to install on the ZM-43/52, insert a spacer at the mounting hole of the upper left, then fix it with the mounting screws (M3x15).
   (Tightening torque of the mounting screws: 3 to 5 kgf-cm)



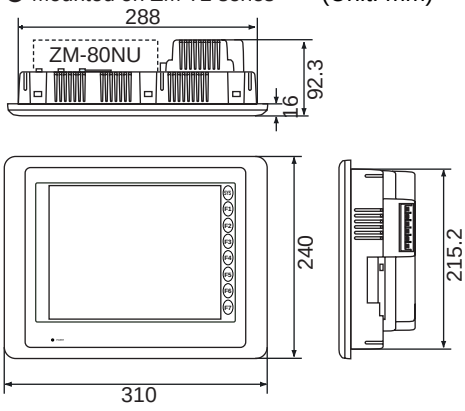
3. Wire the communication cable.

External dimensions when mounted ZM-80NU

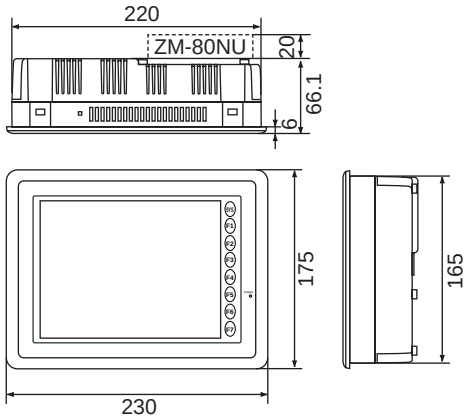
● Mounted on ZM-82 series



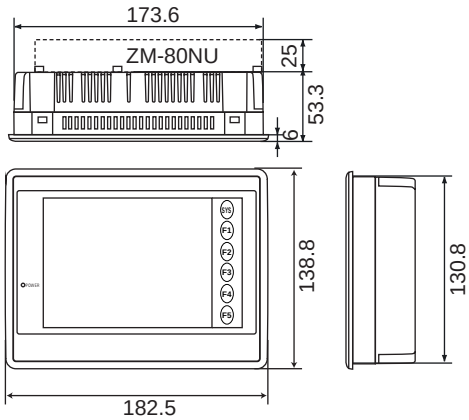
● Mounted on ZM-72 series (Unit: mm)



● Mounted on ZM-52 series

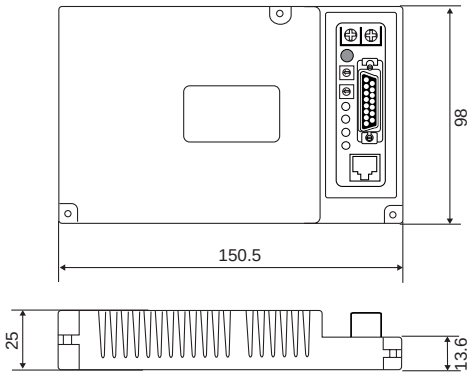


● Mounted on ZM-43 series



■ External dimensions of ZM-80NU

(Unit: mm)



Wiring

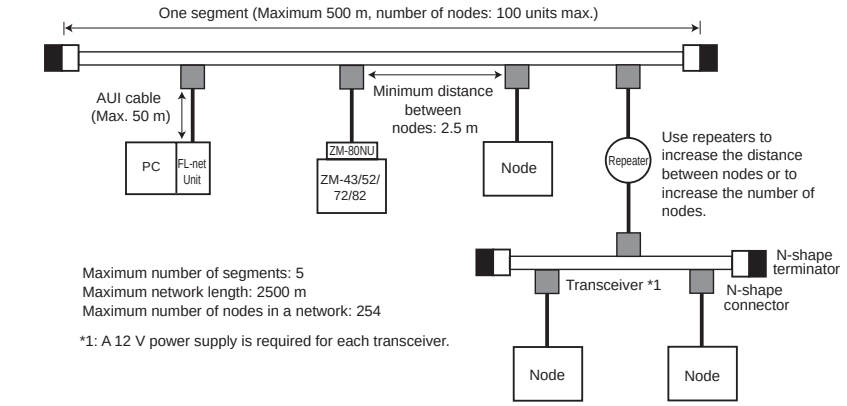
In case of connecting by AUI

■ 10BASE5

The following devices are required in case of connecting with 10BASE5:

- Coaxial cable for 10BASE5
- AUI cable
- N-type connector
- N-type terminator
- Transceiver
- Power supply for the transceiver: 12 VDC

- When using the cables with the FL-net



■ Transceiver

The transceiver should have the SQE TEST function.
(SQE TEST : Signal Quality Error Test)

Recommended transceiver

Maker Name	Model	Remarks
NEC	N4680-10	JAE tapped type
Hirakawa Hutech	HLT-200TD	JAE tapped type

The I/F unit may be broken if the AUI connector is subject to strong force.
Use the AUI cable when connecting to the transceiver.

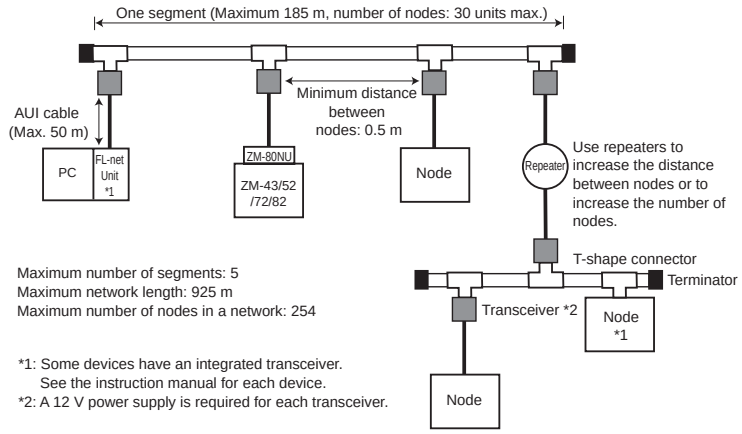
When the power lamp of the transceiver is not turned on, check the wiring of 12 VDC power supply, then replace the fuse (*refer to P3-2) of ZM-80NU.

■ 10BASE2

The following devices are required in case of connecting with 10BASE2:

- Coaxial cable for 10BASE2
- AUI cable
- T-type connector
- Terminator for 10BASE2
- Transceiver
- Power supply for the transceiver : 12 VDC

- When using the cables with the FL-net



■ Transceiver

The transceiver should have the SQE TEST function.
(SQE TEST : Signal Quality Error Test)

Recommended transceiver

Maker Name	Model	Remarks
NEC	N4680-10	JAE tapped type
Hirakawa Hutech	HLT-200TD	JAE tapped type

The I/F unit may be broken if the AUI connector is subject to strong force.
Use the AUI cable when connecting to the transceiver.

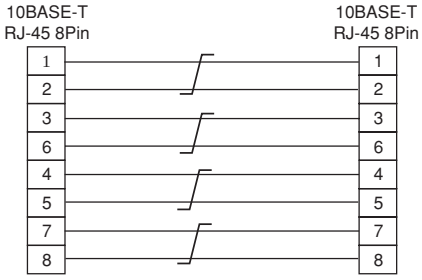
When the power lamp of the transceiver is not turned on, check the wiring of 12 VDC power supply, then replace the fuse (*refer to P3-2) of ZM-80NU.

In case of connecting by 10BASE-T

■ When HUB is used:

◇Straight◇

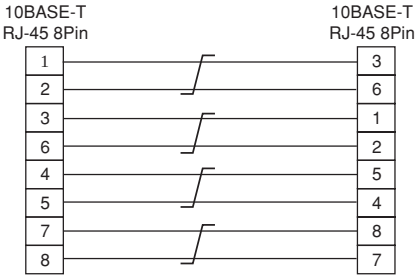
(Use HUB)



* Twisted pair cable without shields

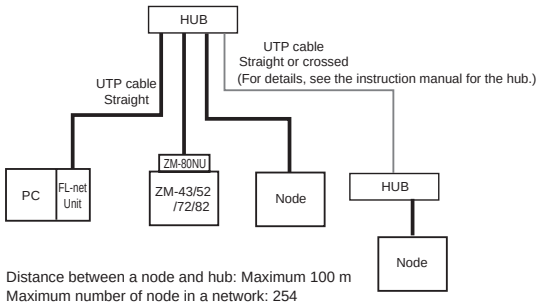
◇Cross◇

(Do not use HUB)



* Twisted pair cable without shields

- When using cables with the FL-net



Distance between a node and hub: Maximum 100 m
Maximum number of node in a network: 254

■ Cable

Recommended cable (10BASE-T)

Each maker	Twisted pair cable category 5

Never connect the 10BASE-T cable from a modular connector on a computer, hub, or programmable controller to the modular jack (MJ1/2) on the ZM-80NU. The computer, hub, or programmable controller may be damaged by excessive current.
Attach the "Accident prevention seal" (included as an accessory) near the MJ1/2 jack, to alert anyone plugging in cables. ⇨ See page 3-2.

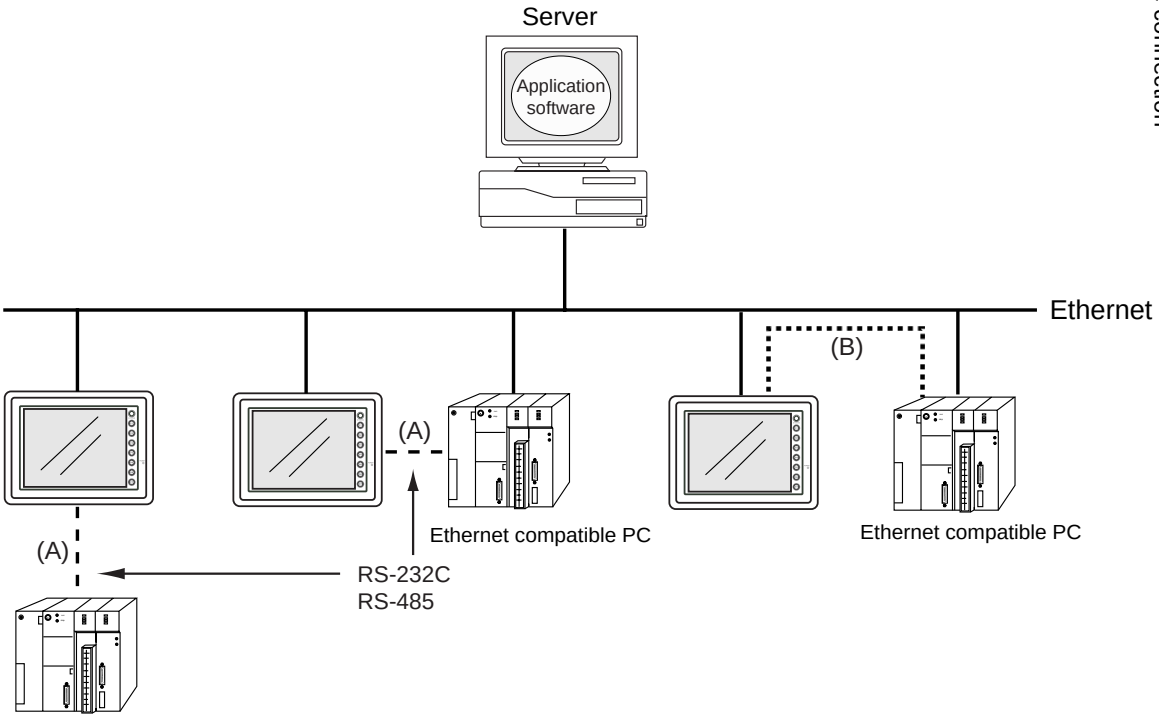
Ethernet
(Chapter 4 to 9)

4 System setting

System setting of ZM-71SE for screen edit software is explained as follows.
Refer to "Instruction Manual" for other setting methods and the way to use.

Example of connection

There are two ways of connection between the ZM-43/52/72/82 and a PC.
(A) Connecting to a PC with the interface of RS-232C or RS-485 --- P4-2
(B) Connecting to a PC which is on the Ethernet --- P4-3

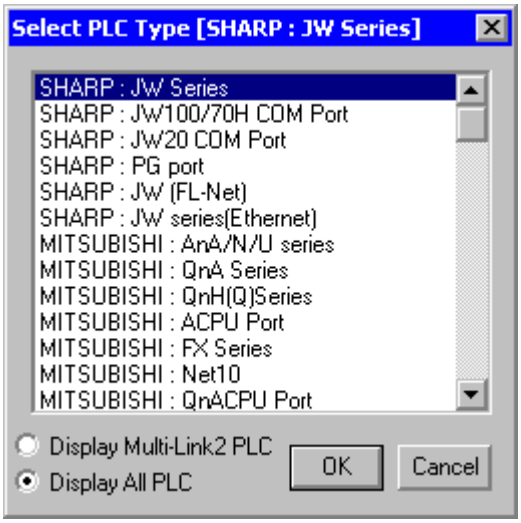


The system setting details vary with connections whether it is (A) or (B) above.
Check the connecting method before setting the ZM-71SE.

(A) Connection by RS-232C or RS-485

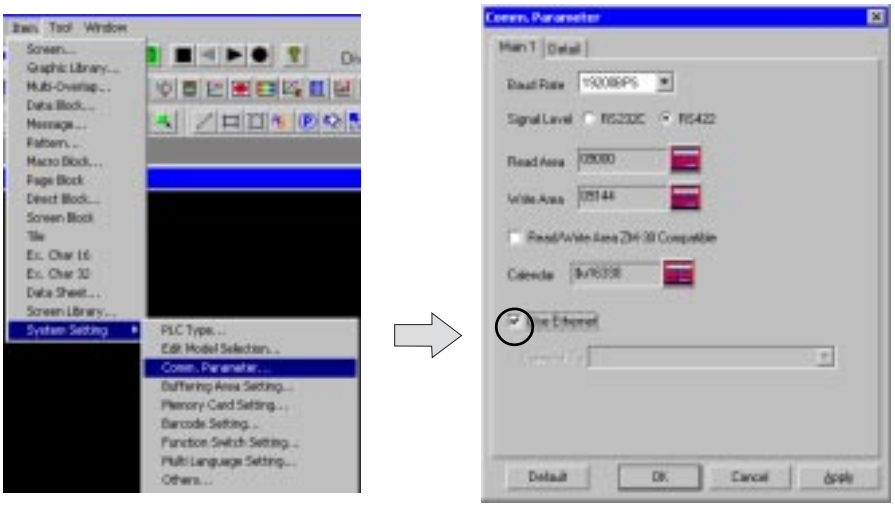
PC type setting

Select the PC to be used on [Select PLC Type (P)] menu. Access this menu from [Item (I)] -> [System Setting (A)].



Comm. Parameter setting

Open [Comm. Parameter (T)] from [Item (I)] -> [System Setting], and click the [Use Ethernet] box.



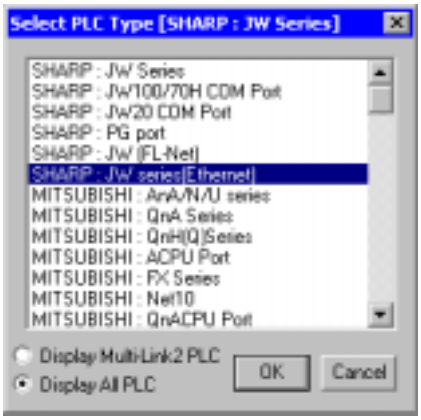
Open the network table dialog from [Item (I)] -> [System Setting (A)]. On the table, set details.

Refer to the Chapter 5 in this manual for editing the network table.

(B) Connection to PC on Ethernet

PC type setting

Access [Select PLC Type (P)] menu from [Item (I)] -> [System Setting (A)]. Select the PC indicated as "XXXX (Ethernet)" on the [Select PLC Type (P)] dialog.

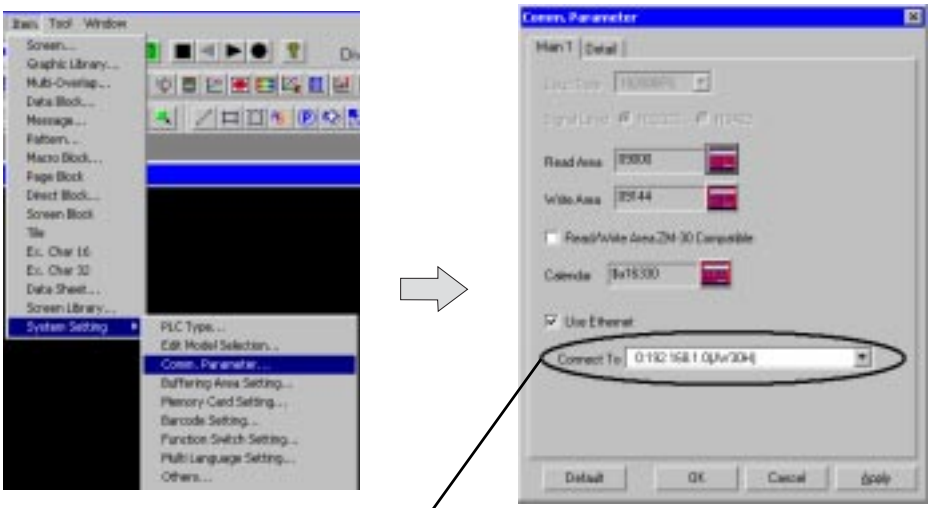


As of January, 2001, the PCs supported are as follows:

- SHARP JW series
- Mitsubishi QnA series, Q series
- Yokogawa FA-M3

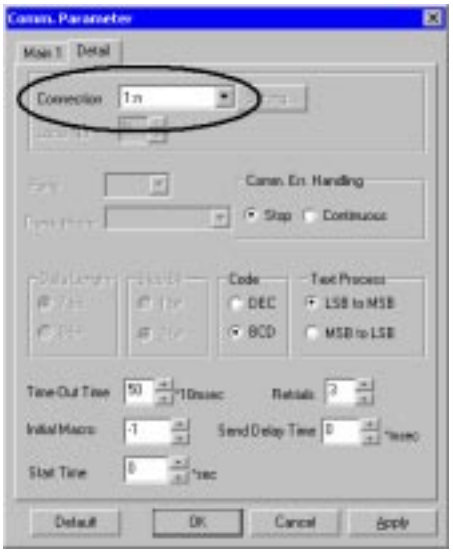
Comm. Parameter setting

Select the PC which the ZM-43/52/72/82 is connected to be used from [Item (I)] -> [System Setting (A)] -> [PC type… (P)], in that order. (*See P4-4.)



"No./ IP address/ Host Name" set in the Network Table will be displayed. (Refer to the Chapter 5.)

In case of communicating with more than one PC of same models on the Ethernet, select [1: n] from [Connection] box.
In this case, the Read Area/Write Area are set to a PC specified by [Connect To].



Open the network table dialog from [Item (I)] -> [System Setting (A)], and set details of the network table.
Refer to the Chapter 5 in this manual for network table.

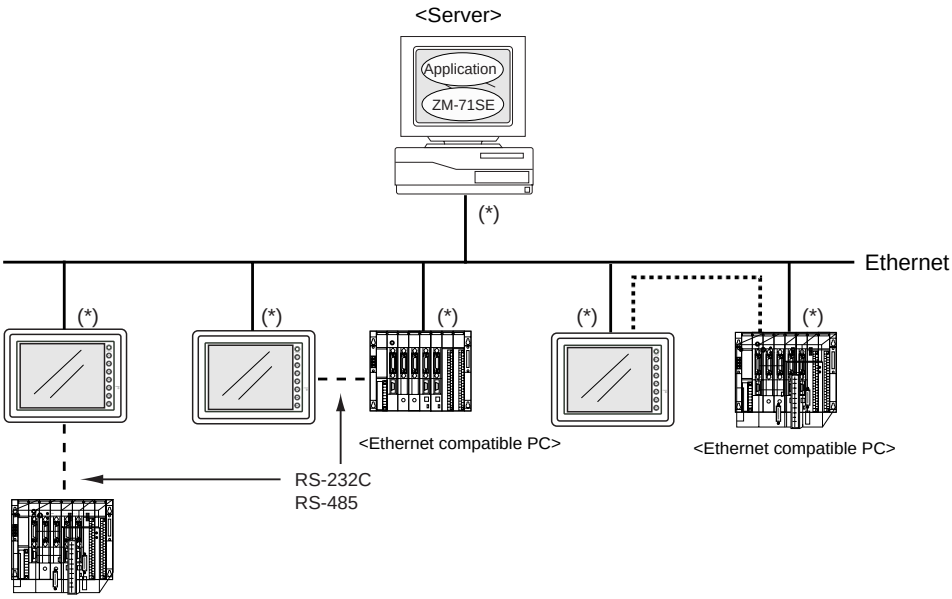
* [Connect To] cannot be specified if the Network Table has not yet been set.

Set the [Comm. Parameter…] again after editing the network table from [Item (I)] -> [System Setting (A)] -> [Network Table… (H)], in that order.

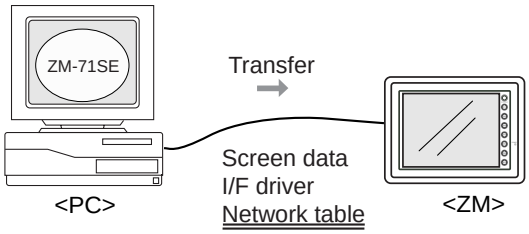
5 Editing network table

Network table

◎ The network table is used to register ZM-43/52/72/82, PC, or personal computer which is connected to the Ethernet.
In case of the network shown below, the nodes with (*) should be registered in the Network Table.



◎ The Network table is transferred to the ZM together with the screen data.

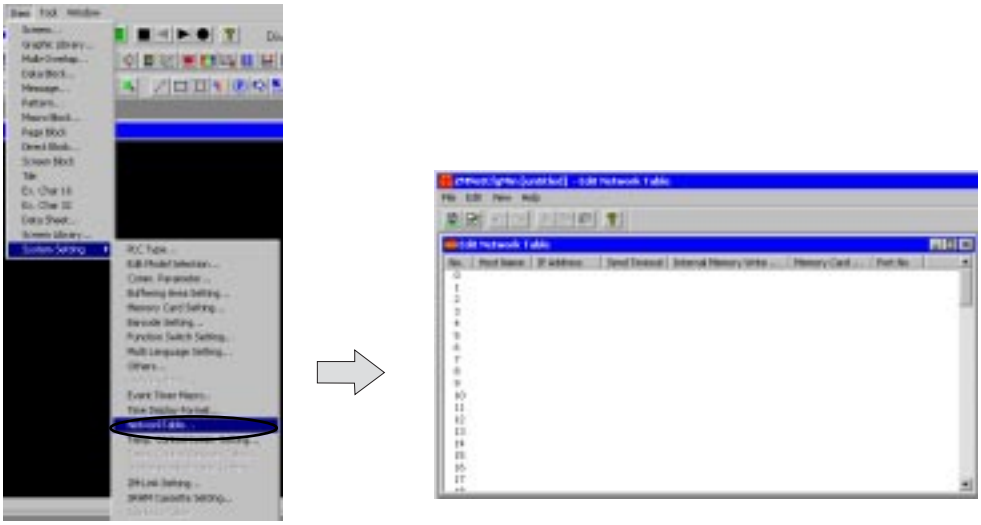


Make sure to edit the [Network Table…(H)] after "Use Ethernet" option is checked on the [Comm. Parameter setting (T)] dialog.

Start and quit the software

Start

Select [Item (T)]-> [System Setting (A)]-> [Network Table…(H)], in that order.
A network table editing screen is displayed.



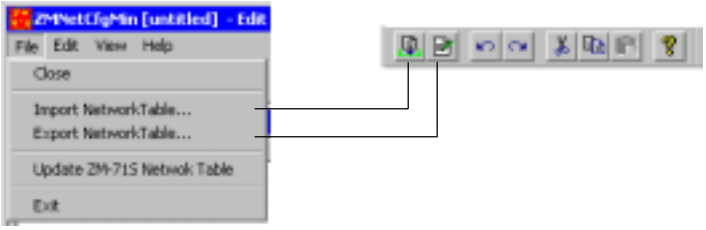
Quit

Select [File (F)] -> [Exit (X)] or [Close] icon.

Menu bar and icons

Each icon represents the following menu:

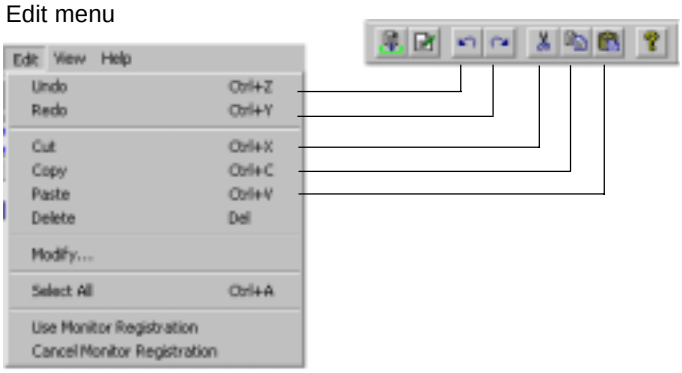
◆ File menu



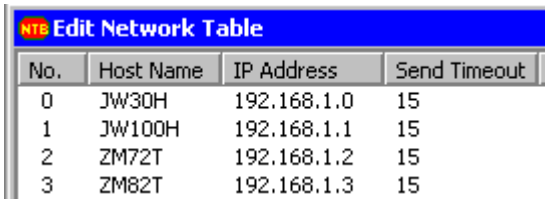
- Import Network Table (I)
  Open the Network Table which is already saved as the file.

- Export Network Table (E)
  Save the Network Table currently edited as a file.

◆ Edit menu



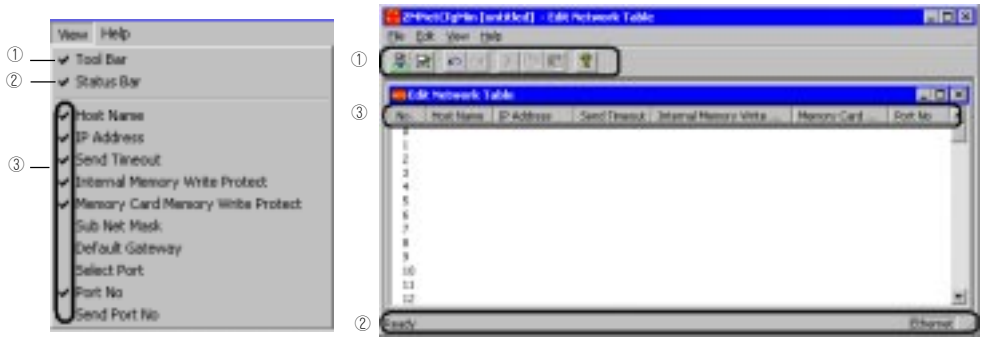
- Use Monitor Registration (S)
  In case of communicating with the PC on the Ethernet, only one of ZM units can use monitor registration.
  A symbol is indicated on the left side of the Network Table number.


Edit Network Table
No. Host Name IP Address Send Timeout
0 JW30H 192.168.1.0 15
1 JW100H 192.168.1.1 15
2 ZM72T 192.168.1.2 15
3 ZM82T 192.168.1.3 15

- Cancel Monitor Registration (N)
  Click this when canceling the monitor registration.

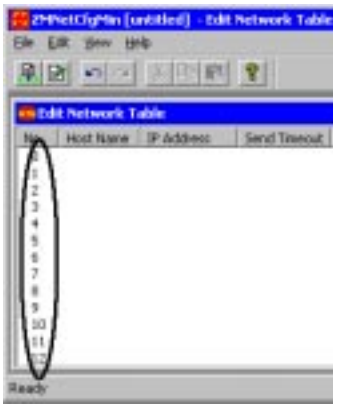
◆ Display menu

Items checked are displayed on the editing screen.



How to set Network Table

The network dialog is displayed by double-clicking a number.



① Host name

Enter host name that is used on the Ethernet such as ZM.

② IP address

Enter IP address.

The IP address should be matched with that of the PC when using the PC which supports Ethernet. For setting of the IP address at the PC side, refer to the respective PC manuals.

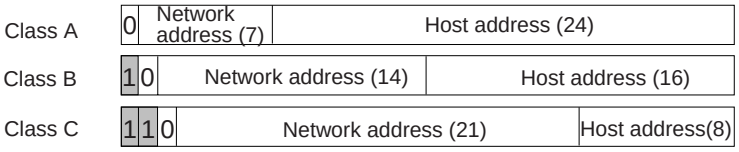
The PC should match with that of the PC when using the PC which supports Ethernet. To set the IP address at the PC side, open [Property] of [TCP/IP] in the [Network] on the Windows.

To connect to an intracompany network, consult with a person in charge of the network about it.

IP address

This is an address which is used for recognizing each node on the Ethernet, and should be unique.

The IP address is 32-bit data which consists of the network address and the host address.



< Notation >
A string of 32-bit data is divided into four, and each segment delimited with a period is in decimal notation.
< E.g. > The IP address in the Class C shown as below is represented as "192.128.1.50."
11000000 10000000 00000001 00110010

③ Send timeout time
Set the time to monitor the response from the PC.

④ Port No.
Set the port number to be used.
* Port number may be fixed depending on the PC model. Refer to respective PC manuals.
< E.g. >

SHARP JW series	Default. No changes to the settings are needed (However, they can be changed.)
YOKOGAWA FA-M3	12289 : Fixed
MITSUBISHI Q series	5000 : Default (can be changed.)

Port No.
Each node run more than one application, and it communicates with the applications on other nodes. Therefore, the port No. is required to identify which application the data should be passed.

The port No. is 16-bit data (0 to 65535). However, the setting range on the ZM-80NU is 1024 to 65535 since some numbers are already used. We recommend to use larger number as possible.

⑤ Select Port
Select either AUI or 10BASE-T.

⑥ Memory Protect

Click the box to write protect internal memory or memory card memory box.

⑦ Default Gateway

Click the box to set the default gateway.

Default Gateway

A gateway and a router are used for communicating between different networks.

The IP address of the gateway (router) should be set to communicate with the node(s) on other network.

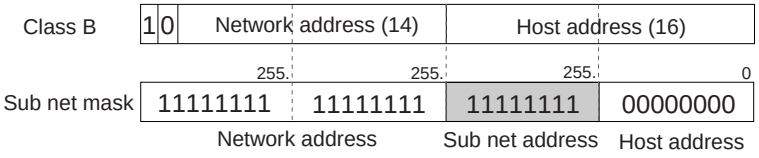
⑧ Sub Net Mask

Check the check box when setting the sub net mask.

Sub Net Mask

A sub net mask is used for dividing one network address into multiple networks (sub net).

The sub net is assigned by specifying a part of the host address in the IP address as a sub net address.



6 Macro

The following explains the macro commands (SEND/EREAD/EWRITE) which are used for the Ethernet. For other commands, refer to the "ZM-71SE Instruction Manual."

Macro commands

■ EREAD

Words from F1 in the ZM-43/52/72/82 which has the Network Table No. specified by F3 are moved. F2 designates the number of the word.

Usable devices

	Internal memory	PC memory	Constant	Memory card	Indirect	W word	IP address
F0	○	○		○	○		
F1	○	○		○	○		
F2	○		○				
F3	○		○				○

EREAD: Read in the memory EREAD F0 = F1 C: F2 F3

(E.g.) Macro command at the ZM: A side

The macro command is as below when the ZM: A reads the data from the PC: A, then transfer the data to the PC: A.

[Description] EREAD 19200 = 19100 C: 2 B

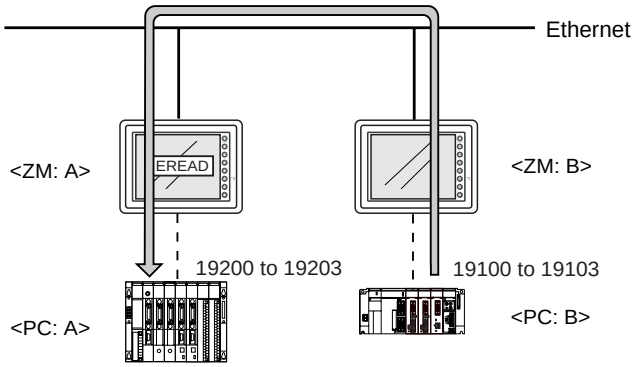
Top address of the target

Top address of the source

Number of the words to be transferred

Source IP address

[Content] Two words starting with 19100 in the PC: B is read in 19200 in the PC: A.



■ EWRITE

Words starting with the F2 address is written in the F0 address in the ZM which has the network number assigned by the F1.
F3 designates the number of the word.

Usable devices

	Internal memory	PC memory	Constant	Memory card	Indirect	W word	IP address
F0	○	○		○	○		
F1	○		○				○
F2	○	○		○	○		
F3	○		○				

EWRITE: Write in the memory EWRITE F0 F1 = F2 C: F3

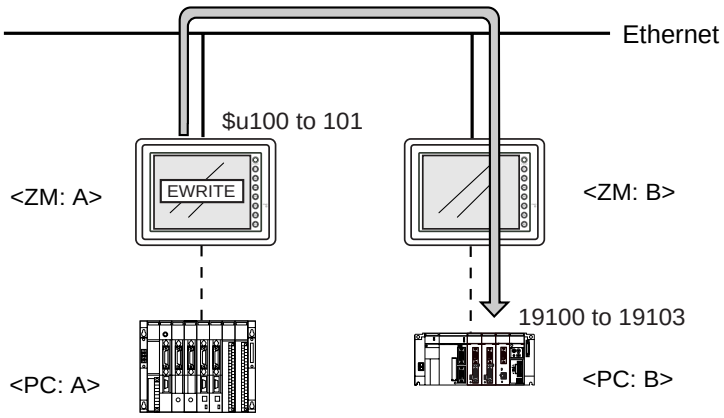
E.g.) Macro command at the ZM: A side

The macro command is as below when the data in the ZM: A is written in the PC: B.

[Description] EWRITE 19100 B = $u100 C: 2

- 19100: Top address of the target
- B: Target IP address
- $u100: Top address of the source
- 2: Number of the word to be transferred

[Content] Two word starting with $u100 in the ZM: A is written in the 19100 of the PC: B.



7 System memory

The status of the Ethernet is output to the system addresses ($s) of the ZM-43/52/72/82.
This chapter explains only the addresses which the status of the Ethernet is output ($s514 to 619).
For other addresses, refer to the "ZM-71SE Instruction Manual."

■ List of addresses

Address	Contents
⋮	⋮
$s514	Macro User Request waiting (0: absence 1:presence)
515	The result of executing the Macro User Request waiting
516	
517	
518	Status of the Ethernet
519	
520	Status of the Network Table 0
521	Status of the Network Table 1
522	Status of the Network Table 2
523	Status of the Network Table 3
524	Status of the Network Table 4
525	Status of the Network Table 5
526	Status of the Network Table 6
527	Status of the Network Table 7
528	Status of the Network Table 8
529	Status of the Network Table 9
530	Status of the Network Table 10
531	Status of the Network Table 11
532	Status of the Network Table 12
533	Status of the Network Table 13
534	Status of the Network Table 14
535	Status of the Network Table 15
536	Status of the Network Table 16
537	Status of the Network Table 17
538	Status of the Network Table 18
539	Status of the Network Table 19
540	Status of the Network Table 20
541	Status of the Network Table 21

Address	Contents
$s542	Status of the Network Table 22
543	Status of the Network Table 23
544	Status of the Network Table 24
545	Status of the Network Table 25
546	Status of the Network Table 26
547	Status of the Network Table 27
548	Status of the Network Table 28
549	Status of the Network Table 29
550	Status of the Network Table 30
551	Status of the Network Table 31
552	Status of the Network Table 32
553	Status of the Network Table 33
554	Status of the Network Table 34
555	Status of the Network Table 35
556	Status of the Network Table 36
557	Status of the Network Table 37
558	Status of the Network Table 38
559	Status of the Network Table 39
560	Status of the Network Table 40
561	Status of the Network Table 41
562	Status of the Network Table 42
563	Status of the Network Table 43
564	Status of the Network Table 44
565	Status of the Network Table 45
566	Status of the Network Table 46
567	Status of the Network Table 47
568	Status of the Network Table 48
569	Status of the Network Table 49
570	Status of the Network Table 50
571	Status of the Network Table 51
572	Status of the Network Table 52
573	Status of the Network Table 53
574	Status of the Network Table 54
575	Status of the Network Table 55
576	Status of the Network Table 56
577	Status of the Network Table 57
578	Status of the Network Table 58
579	Status of the Network Table 59
580	Status of the Network Table 60
581	Status of the Network Table 61
582	Status of the Network Table 62
583	Status of the Network Table 63

Address	Contents
$s584	Status of the Network Table 64
585	Status of the Network Table 65
586	Status of the Network Table 66
587	Status of the Network Table 67
588	Status of the Network Table 68
589	Status of the Network Table 69
590	Status of the Network Table 70
591	Status of the Network Table 71
592	Status of the Network Table 72
593	Status of the Network Table 73
594	Status of the Network Table 74
595	Status of the Network Table 75
596	Status of the Network Table 76
597	Status of the Network Table 77
598	Status of the Network Table 78
599	Status of the Network Table 79
600	Status of the Network Table 80
601	Status of the Network Table 81
602	Status of the Network Table 82
603	Status of the Network Table 83
604	Status of the Network Table 84
605	Status of the Network Table 85
606	Status of the Network Table 86
607	Status of the Network Table 87
608	Status of the Network Table 88
609	Status of the Network Table 89
610	Status of the Network Table 90
611	Status of the Network Table 91
612	Status of the Network Table 92
613	Status of the Network Table 93
614	Status of the Network Table 94
615	Status of the Network Table 95
616	Status of the Network Table 96
617	Status of the Network Table 97
618	Status of the Network Table 98
619	Status of the Network Table 99

■ Addresses

◎ $s514, 515

These addresses are relevant to the macro command like [SEND], [EREAD] and [EWRITE].

$s514 : Set the executing status of the macro.

In case of [0], the next step of the macro is executed without waiting the completion of the command when the request to the Ethernet is performed.

In case of [other than 0], waiting status continues until the command completes, and then the next step of the macro is executed.

$s515 : The result of the execution of the macro is stored.

The value other than [0] shows error.

Refer to the error codes (p9-3) for the contents.

In case $s514 is [0], the contents before execution of the command request is stored.

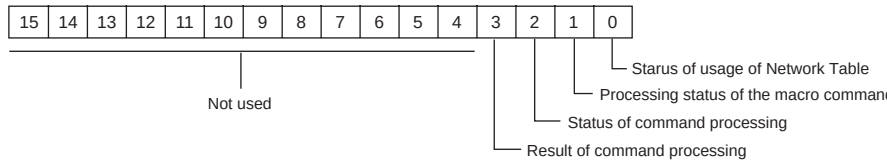
◎ $s518

Current status of the Ethernet is stored. The value other than [0] is error.

Refer to the error codes (p9-2) for the contents of the error.

◎ $s520 to 619

The status of the Network Table No. 0 to 99.



- Bit 0 (Status of usage of Network Table)

  [0]: Not used [1]: Used

- Bit1 (Processing status of the macro command)

  The status of executing [SEND], [EREAD] or [EWRITE] command is stored.

  [0]: Waiting [1]: Currently executing

- Bit 2 (Status of command processing)

  [0]: Waiting [1]: Currently executing (Read/Write command)

- Bit 3 (Result of command processing)

  The result of execution of [SEND], [EREAD] or [EWRITE] is stored.

  [0]: Normal [1]: Error

- Bit 4 to 15 (Reserved)

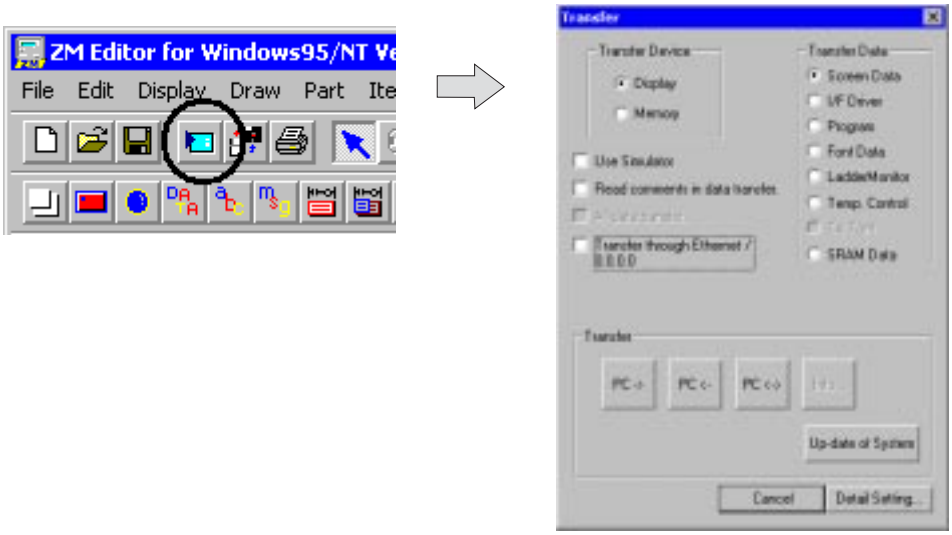
  These bits are currently not used, and should be set to [0].

8 Transferring screen data

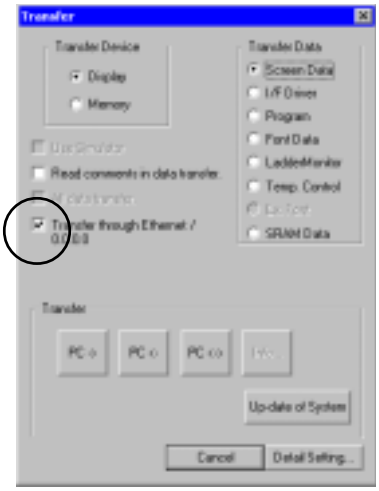
This chapter explains how to transfer the screen data from the ZM-71SE for screen edit software on the server through the Ethernet.
Regarding how to transfer the screen data by using the ZM-80C, refer to the "ZM-71SE Instruction Manual."

How to transfer data

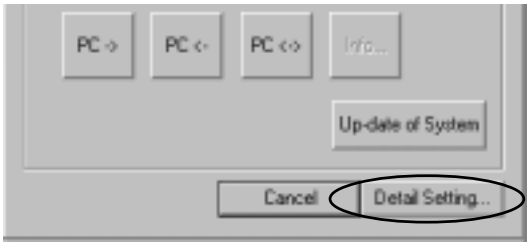
1. Click the [Transfer] icon, then the [Transfer] dialog is displayed.



2. Check the [Transfer through Ethernet] box.

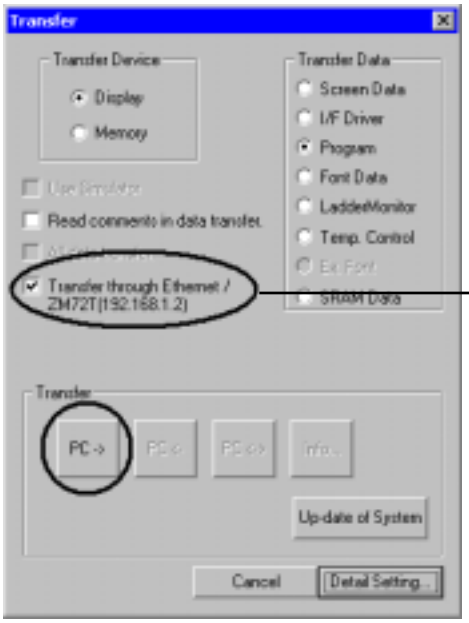


3. Click the [Detail Setting…] button. The [IP address Setting] dialog is displayed.



4. Select the ZM which the screen data is transferred to, and then click the [<<] button. The [Host name] and the [IP address] are displayed. Click the [OK] button.

5. Confirm the target IP address, and then click the [PC->] button.



Target IP address

6. Transferring the screen starts.

Notes

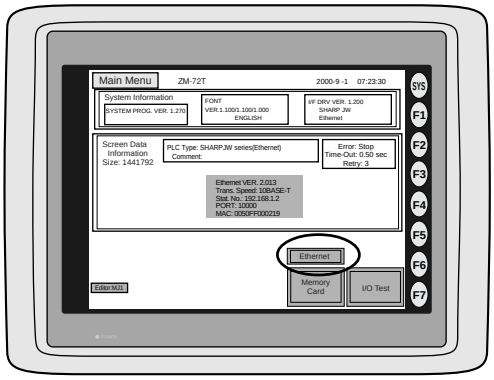
In case the ZM is replaced due to a trouble, screen data may not be able to be transferred from the server as a new ZM module may not have the network table in it.
In such case, the following items can be temporarily set from the Main Menu screen.

- IP address
- Default gate way
- Subnet mask

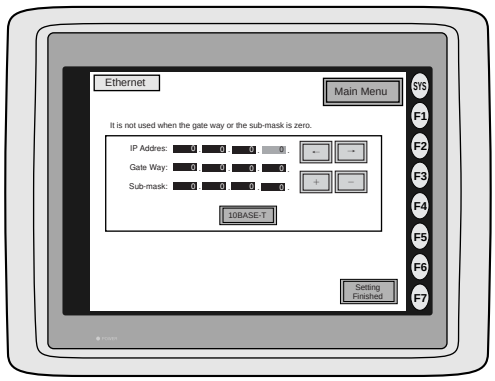
The port number is fixed to 10000.
Above mentioned items are updated when the network table is transferred from the ZM-71SE on the server.

Setting procedure

1. Press the [Ethernet] button on the Main Menu screen.



2. The [Ethernet] screen is displayed.
   Enter IP address and select connection method (10BASE-T or AUI).
   If required, also set the gate way and subnet mask.



3. After completing the setting, press the [Setting Finished] button to return to the Main Menu screen.

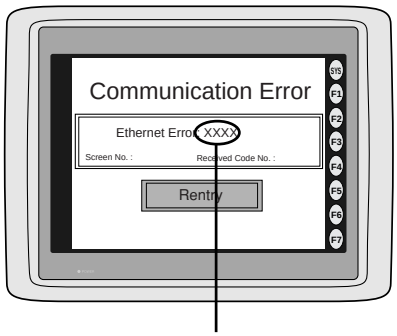
4. Transfer the screen data from the server in accordance with the procedure on P8-1.

9 Error display

This chapter explains the error messages which are displayed on the ZM-43/52/72/82 and the error being stored in the system memory.

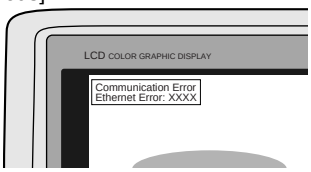
Communication error

During the Ethernet communication, status of the Ethernet is stored in the system memory, $s518. Error occurs when the code other than 0 (normal) is written in the $s518.

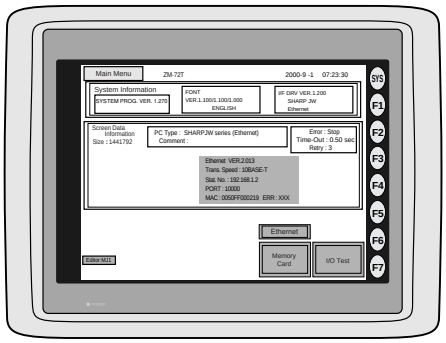


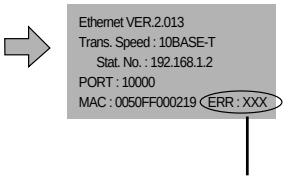
Error number will be displayed here.

* Error will be displayed as shown below when [Comm. Err. Handling] of [Details] in [Comm. Parameter…] is set to [Continuous].



◎ In case of confirming the error on the Main Menu





Error number will be displayed here.

■ System address : $s518

No.	Contents	Measures
0	Normal	
200	Failed in Send request	Turn on the power again. If the error still occurs, consult with our technical support.
201	Send Error	
202	Assigned Send port Error	
300	Network Busy	
301	Protocol Stuck Error	
350		
351		
352		
801	Link Down Error	Check the wiring and connection.
802	Transceiver Error	Check if the transceiver is fautly and cable is properly connected.
900	No IP address at local port	Check whether the IP address of the local port is set at the network table.
901	Duplicated IP address Error	Check whether the IP address on the network table are not doubled with other node.
1000	Ethernet communication module is not mounted	Check if the Ethernet communication module is mounted properly, and then turn on the power again. If the error still occurs, consult with our technical support.
1001	Ethernet communication module is not ready status	
1002	Ethernet communication module DPRAM Error	
1003	No Response from Ethernet communication module	
1004	Ethernet Receive Buffer Over	
1005 1006	Ethernet Send Registration Error I/F unit Non-registered interruption code	
110X	Initialization Error (communication module)	
1120	Dual Port Access Error	
1200	Undefined Register	
1201	Send Buffer Access Area Error	
1202	MAC Address Error	
1203	Port Designation Error	
1301	Watchdog Overflow	
1302	JABBER Error, LAN Controller Error	

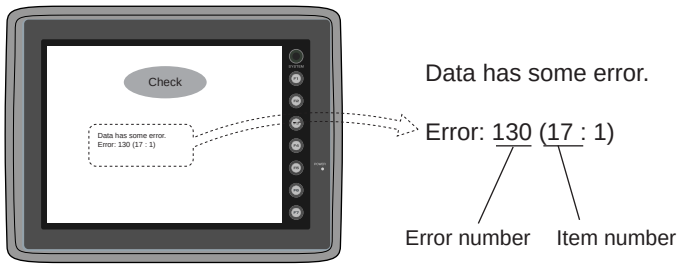
Errors caused by execution of Macro commands

The results of execution of Macro commands SEND/EREAD/EWRITE is stored in the address $s515.

■ System address : $s515 (Response to the request)

Code	Contents	Measures
0	Normal	
Positive number	Communication error	See the previous page.
-30	Timeout	Check whether an error occurs at the target.
-31	Number of words to be send exceeds the limit.	Check the number of the words to be sent at the Macro command editing screen.
-32	Assigned table No. is not defined.	Check the setting of the Network table.
-33	Send command cannot be used.	Check the macro commands on the Macro command editing screen.
-34	Memory capacity shortage	Check the free space of the memory at the local port.
-35	Memory capacity shortage	Check the free memory space in the station you want to communicate with.
-36	The number of bytes or packets received was not appropriate.	Check the number of words requested.
-37	This station has a memory access error.	Check the memory setting requested.
-38	Macro setting error.	Check the macro setting.

Check



◎ Error No. (Refer to the following table.)

Error No.	Contents	Measures
131	The table of the local port has not been set.	Check the port No. of the I/F unit, then confirm whether the local port is set at the Network table editing screen.
133	IP address No. Error.	Check the setting of the IP address at the Network table editing screen.
134	Port No. Error.	Check the setting of the Port No. at the Network table editing screen.

< Note >

Other than above-mentioned errors, there are some errors which usually do not occur.

If this error happen, please consult with our technical support.

* 130 : Network byte error
* 132 : No Network Table/ Different Network Table

FL-net
(Chapter 10 to 15)

10 FL-net

Description of FL-net

■ FL-net concept

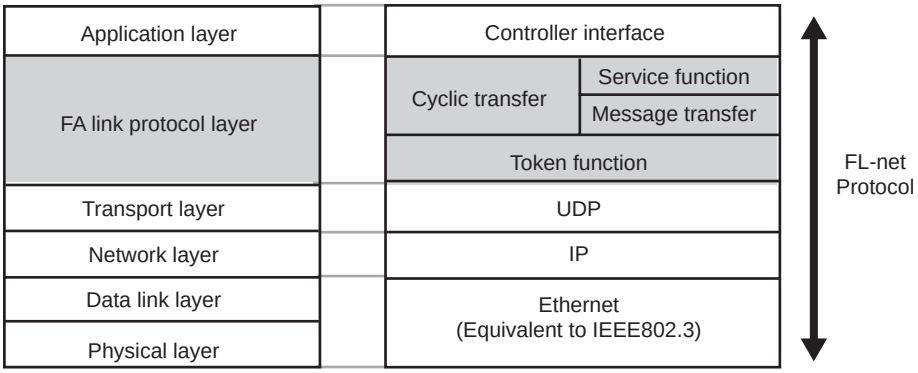
FL-net is an FA control network that uses an Ethernet protocol.
FL-net has a cyclic transfer function and a message transfer function.
The basic concepts of the FL-net are as follows.

- Ethernet protocols are used for communication (physically and as conceptual data links) between FA controllers.
- A UDP/IP scheme compatible with the Ethernet is used. It establishes the basic data transfer procedures.
- While using the basic data transfer methods above, FL-net guarantees data transfer within a specified time by managing and controlling (preventing conflicts) the access to communications by each node in the network.

The goal of the FL-net is to control devices such as programmable controllers (PC), robot controllers (RC), numeric control devices (CNC), and establish an FA control network that allows the exchange of data between personal computers.

■ FL-net protocol

The FL-net consists of the following 6 protocol layers.



■ Features of FL-net transfer system

- It manages the transmission of data using the Master-less Token method, and prevents communication conflicts.
- It is possible to specify a certain refresh cycle interval as the FL-net circulates a Token.
- The specified Token is transmitted together with the cyclic data.
- When starting up, the FL-net sends a token from the node with the lowest node number.
- When a token is not received within a certain interval, the next node sends a token.
- By using the Master-less Token method, even if some nodes are faulty the network will not stop operating.
- The FL-net has an information management table for items such as the operation mode (RUN/STOP) / hardware error (ALARM), so that it can inform other nodes of the operation status.

■ FL-net's IP address

Each node in the FL-net should be set independently using class C addresses. An "IP address" is an address used to identify a specific node (station) when sending data and using an Internet Protocol (IP). Therefore a unique IP address should be assigned to each node or device. The FL-net uses class C IP addresses.

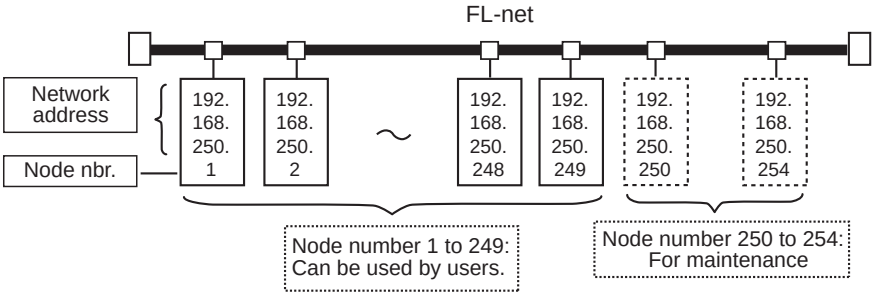
Network address	Host number (node number)
192.168.250	n (n:1 to 254)

Number of nodes and node numbers on FL-net

Up to 254 nodes can be connected. The FL-net uses node numbers from 1 to 254.

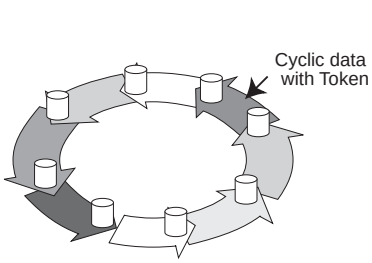
[Node number]

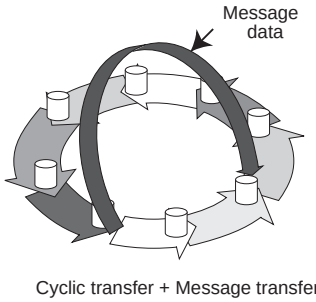
- Node Nos. 1 to 249: For normal equipment in the FL-net.
- Node Nos. 250 to 254: For maintenance of the FL-net.
- Node No. 255: Used internally by the FL-net. The user cannot assign this number. (It is used to transfer broadcast of the global address.)
- Node No. 0: Used internally by the FL-net. The user cannot assign this number.



Data communication type

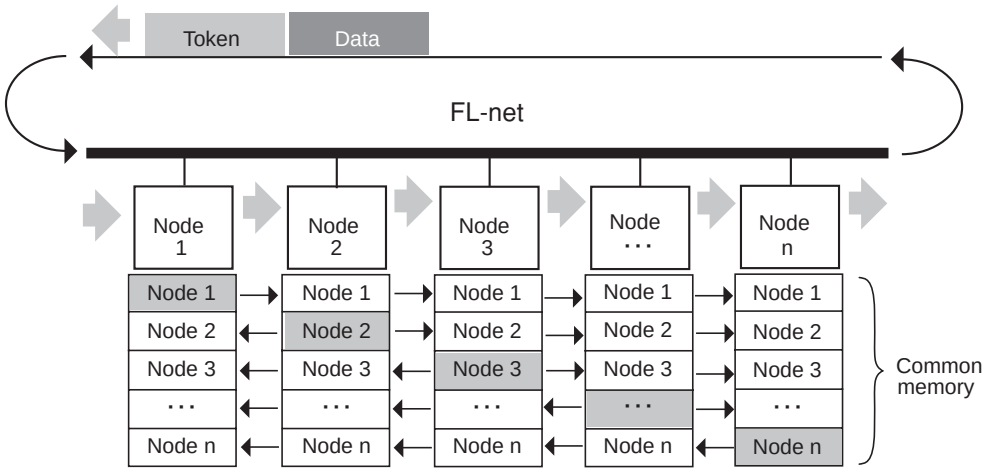
FL-net data communication supports both "cyclic transfer" and "message transfer."





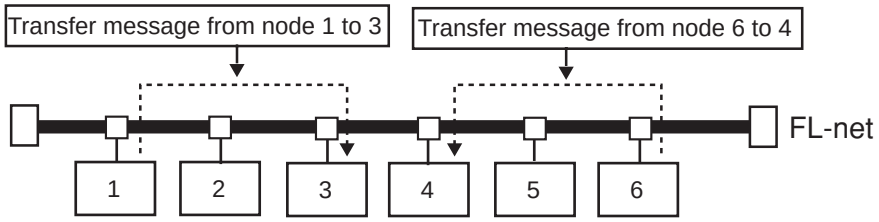
■ Cyclic transfer

With cyclic transfer, the module sends data at certain intervals. Each node can share data through a common (shared) memory.



■ Message transfer

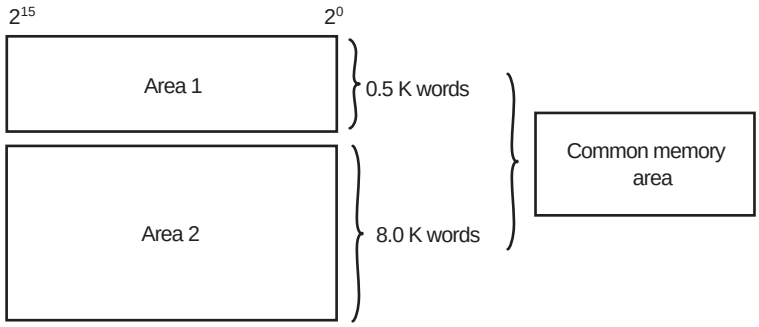
In the message transfer operation, the module sends data non-cyclically.
Normally, when a request to send occurs, the FL-net will communicate with a certain node.



Transfer data volume

■ Cyclic transfer

In a cyclic transfer, the FL-net has a 0.5 K words + 8.0 K words = 8.5 K word transfer area.
The maximum amount of data that can be transferred cyclically at one time by one node is 8.5 K words.
One word = 2 bytes.



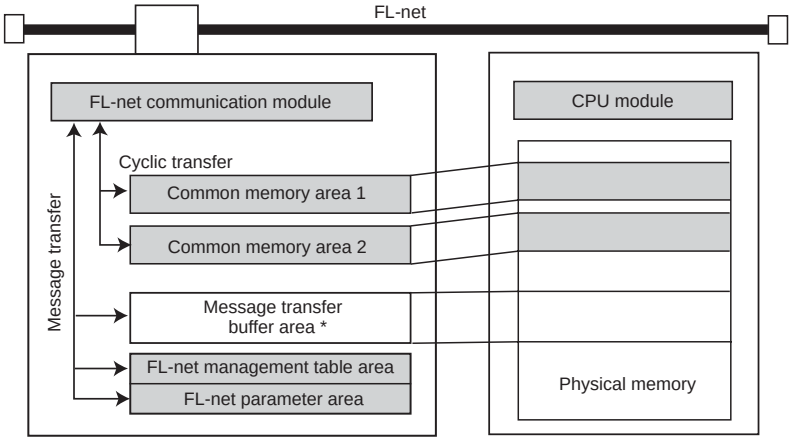
■ Message transfer

The maximum amount of data that can be transferred in one message frame is 1024 bytes (excluding the header section.)

Transfer cycle

In the cyclic transfer operation, the module refreshes the common memory almost constantly. The module controls the transfer of messages so that the refresh interval of the common memory does not exceed the allowable refresh cycle interval for a single message transfer.
Each node always monitors the messages being transferred throughout the network, waiting to receive a token addressed to itself. If no message transferred by the network within this cycle, the refresh cycle interval is increased to 120 % of its current value.
Due to the monitoring process above, the refresh cycle interval is automatically determined by the number of nodes active on the network.

Data area and memory



* The ZM-80NU does not have a message transfer buffer area.

Communication management table

The status of each node is controlled using an individual node management table (maintained by the node itself,) a participating node management table, and a network management table.

■ Local node management table

The settings in each local node management table are controlled by the node itself.

This table is stored in system memory ($s). [GET_STATUS_FL] Data are refreshed by executing this macro.

Item	Number of bytes	Description
Node number	1 byte	1 to 254
Area 1 of common memory: Data top address	2 bytes	Word address (0 to 0x1FF)
Area 1 of common memory: Data size	2 bytes	Size (0 to 0x1FF)
Area 2 of common memory: Data top address	2 bytes	Word address (0 to 0x1FFF)
Area 2 of common memory: Data size	2 bytes	Size (0 to 0x1FFF)
Upper layer status	2 bytes	RUN/STOP/ALARM/WARNING/NORMAL
Token monitor time	1 byte	In units of 1 msec.
Minimum separation of frames	1 byte	In units of 100 µsec.
Vendor name *	10 bytes	Vender name
Manufacturer name *	10 bytes	Manufacture model name, device name
Node name (facility name)	10 bytes	Node name by user entry
Protocol version	1 byte	Fixed to 0x80
FA link status	1 byte	Participate/leave
Local node's status	1 byte	Doubled node number detection, etc.

* This table is not displayed when a ZM-43/52/72/82 is used.

■ Participating node management table

The participating node management table contains data related to the nodes currently participating in the network.

[GET_STATUS_FL] Data are stored into system memory ($s) by executing this macro.

Item	Number of bytes	Description
Node number	1 byte	1 to 254
Upper layer status	2 bytes	RUN/STOP/ALARM/WARNING/NORMAL
Area 1 of common memory: Data top address	2 bytes	Word address (0 to 0x1FF)
Area 1 of common memory: Data size	2 bytes	Size (0 to 0x1FF)
Area 2 of common memory: Data top address	2 bytes	Word address (0 to 0x1FFF)
Area 2 of common memory: Data size	2 bytes	Size (0 to 0x1FFF)
Allowable refresh cycle time *	2 bytes	In units of 1 msec.
Token monitor time *	1 byte	In units of 1 msec.
Minimum separation of frames *	1 byte	In units of 100 µsec.
Link status	1 byte	Participate/leave

* This table is not displayed when a ZM-43/52/72/82 is used.

■ Network management table

The network management table contains information common to the network.

Item	Number of bytes	Description
Token latch node number*	1 byte	1 to 254
Minimum separation of frames	1 byte	In units of 100 µsec.
Allowable refresh cycle time	2 bytes	In units of 1 msec.
Measured refresh cycle* time (current value)	2 bytes	In units of 1 msec.
Measured refresh cycle* time (maximum value)	2 bytes	In units of 1 msec.
Measured refresh cycle* time (minimum value)	2 bytes	In units of 1 msec.

* This table is not displayed when a ZM-43/52/72/82 is used.

Cyclic transfer and data area

■ Outline of cyclic transfer process

The cyclic transfer process is a function that supports cyclic data exchanges that occur between nodes.

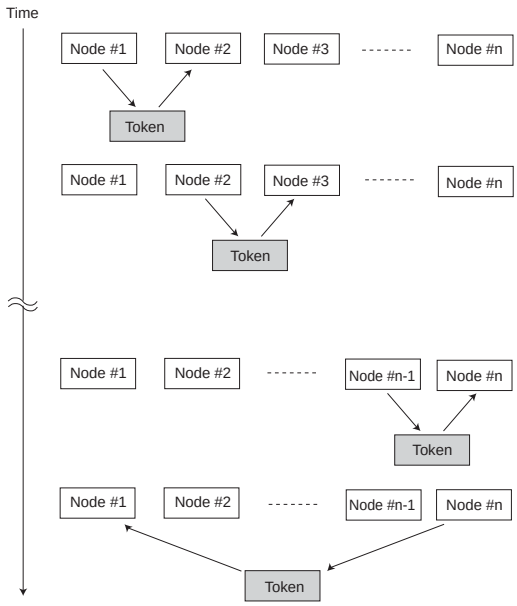
① Establishes the common memory function.

② Transmits when a node receives the token.

③ Nodes which do not execute cyclic transfers within the network are allowed to participate.

④ When received the token, the node sends all the cyclic data that it needs to send.

- Token:
  Generally, only one token exists in a network. If more than one token exists in a network, the token with the lowest destination node number has priority and any other token is discarded.
- Token frame:
  A frame with a token has a destination node number and a transmitting node number. The node whose number matches the destination node number holding the token.
- Token order:
  The token rotation order is determined by the node numbers. The token is passed to the nodes in order that the nodes were registered in the participating node management table. The node with the highest node number hands the token over to the node with the lowest node number.



■ Common memory

The description of the common memory is as follows.

① The common memory allows the memory to be shared between nodes performing a cyclic transfer.

② Two types of areas (area 1 and area 2) are allocated for each node.

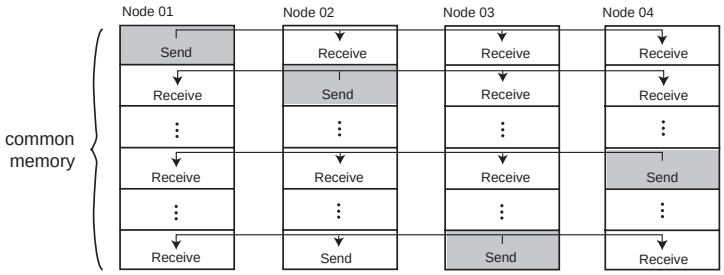
③ If an area needed by a node to send its data exceeds the transfer size allowed for one frame, namely, more than 1024 bytes, the node should use multiple frames to send the data.

④ When receiving multiple frames of related data, as described in point 3) above, the common memory does not renew the common memory details until it has received all of the frames being sent by one node. In other words, it guarantees simultaneity of each node.

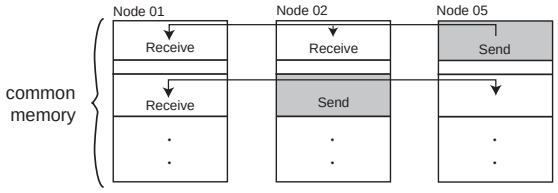
⑤ 8 K bits + 8 K words = 8.5 K words (fixed) of common memory must be reserved in the node communication section.

⑥ The size of areas 1 and 2, used as the sending area for one node in the common memory, can be specified as any size within the maximum size allowed for the area.

⑦ Since each node broadcasts data with a certain interval, it provides a function for sharing the same data throughout the system. Each node in an FL-net is assigned a sending area that does not overlap with the others for exchanging data. In common memory operations, the sending area for one node will be the receiving area for another node.



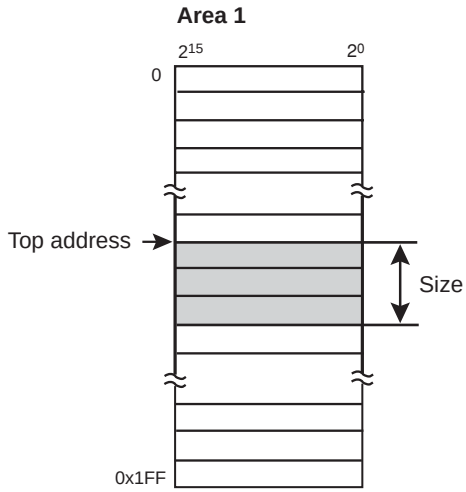
The common memory can also be used exclusively as a receiving area.

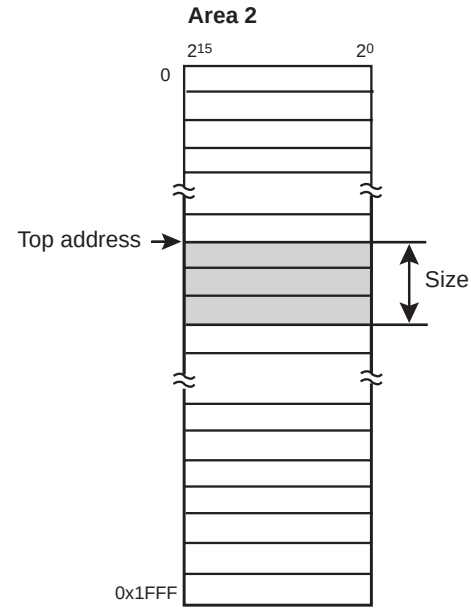


■ Common memory areas 1 and 2

One node can be allocated two data areas (area 1 and area 2) for common memory. To determine the sending area, specify a top address and the size of the area.

To access the area, use word addresses. Area 1 consists of 0.5 K word. Area 2 consists of 8 K words.



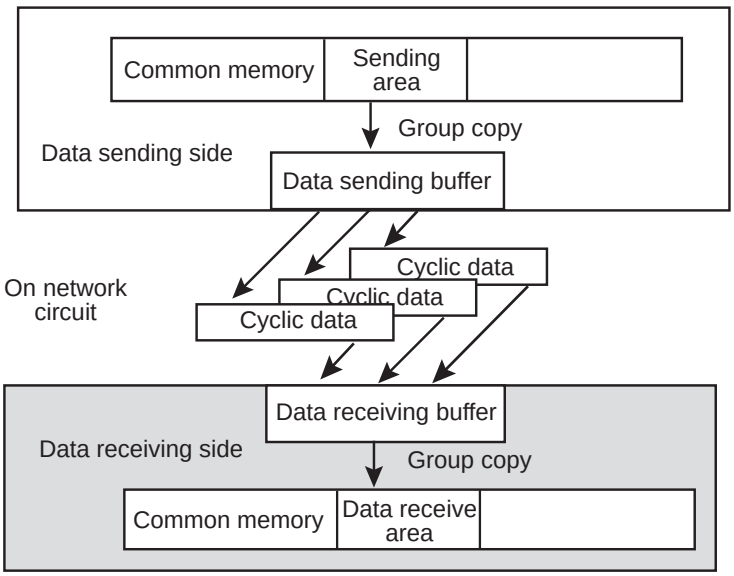


■ Guarantee of simultaneity of data

The cyclic transfer divides data into frames, depending on the amount of data being sent.
The FL-net guarantees the simultaneity on common memory of each node using the following procedures.

- Data transmission timing
  When a node receives a request to send data from the upper layer, it copies its own cyclic data into a buffer and sends the data, one word after another. When the amount of data being sent is more than will fit in one frame, it divides the data in the buffer into multiple frames before sending.

- Refresh timing when receiving
  After a node has received all the cyclic data from some other node, it will refresh the corresponding area while synchronizing with the upper layer.
  When a cyclic data is sent as multiple frames, the receiving node will refresh the area after receiving all the frames from the other node. If any of the frames is missing, it will delete all the data from that node.



Message transfers

■ Outline of message transfer process

The message transfer process is a function that allows asynchronous data to be exchanged between nodes.

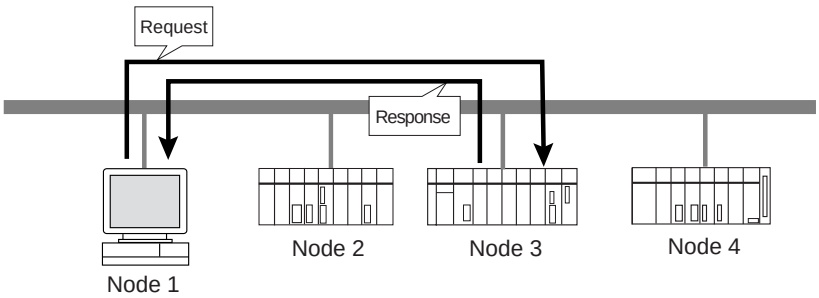
The basic operation of the message transfer process is shown below.

① When a node receives a token, it will send a maximum of one frame of message data before the cyclic frame data sending.

② A maximum of 1024 bytes can be sent at one time.

③ The ZM-80NU uses an algorithm to prevent nodes from exceeding the allowable refresh cycle interval for message transfers.

④ It has a data send confirmation function used to check whether a target node has correctly received the data in a "1: 1" message transfer.



■ Table of ZM-80NU support messages

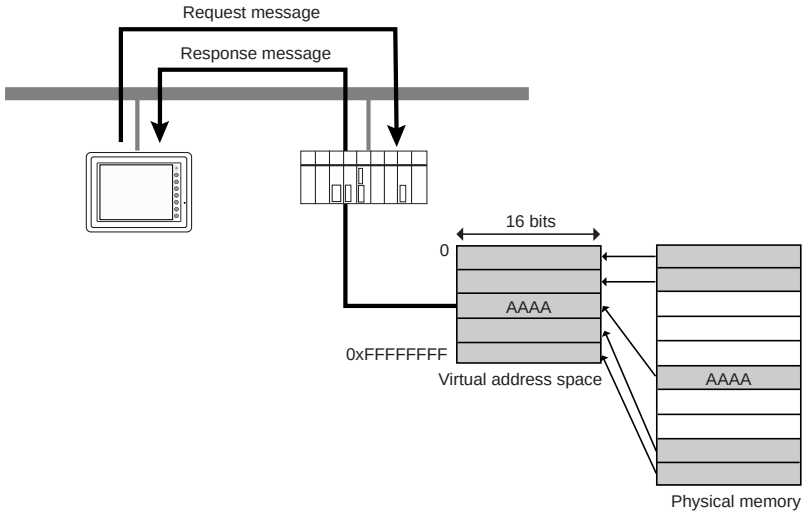
No.	Message	Request (Client function)	Response (Server function)
①	Read/write byte-block data	x	x
②	Read/write word-block data	O	x
③	Read network parameters	x	O
④	Write network parameters	x	x
⑤	Start, stop commands	x	x
⑥	Read profile	x	O
⑦	Read communication log data	x	O
⑧	Clear communication log data	x	O
⑨	Return message	x	O
⑩	Transfer transmission message	x	x

Client function: A function used to send request messages and receive response frames.
Server function: A function to create and send response frames to request messages that are received.

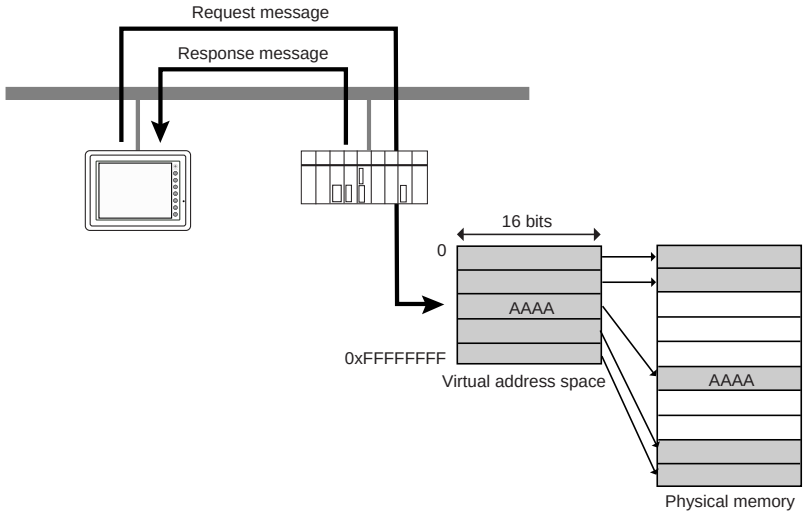
◇No. 2: Read and write word block

A message used to read and write in units of words in the virtual address area (32 bit address area) of a communicating node, through the network.

<Read>



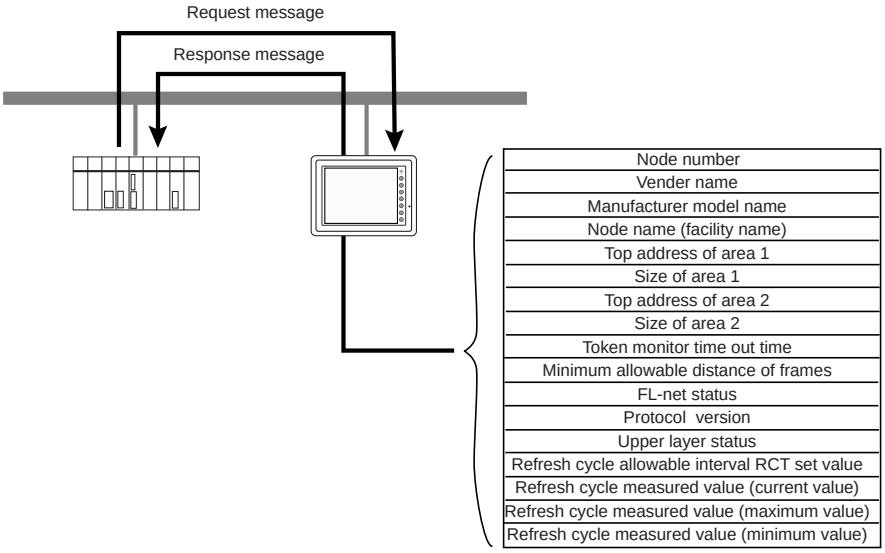
<Write>



◇No. 3: Read network parameters

This is a function used to read the network parameter data for a target node through the network.

It reads the following data.



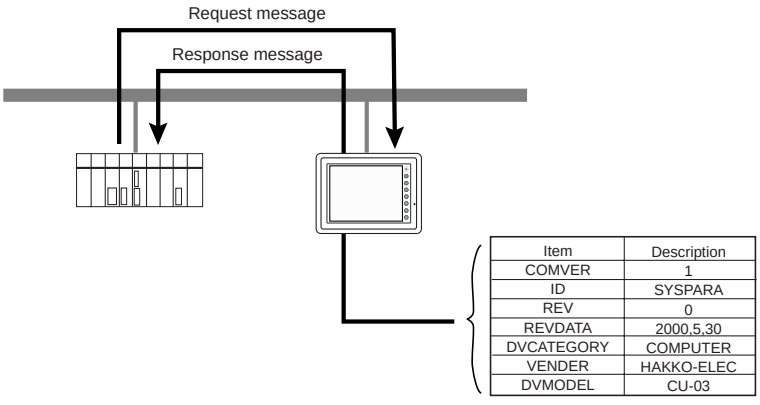
Network parameter

◇No. 6: Read profile

This is a function used to remotely set the system parameters of a device profile that is the data for the receiving node. The following parameters are included in the system parameters.

<System parameters>

- Common parameters (essential)

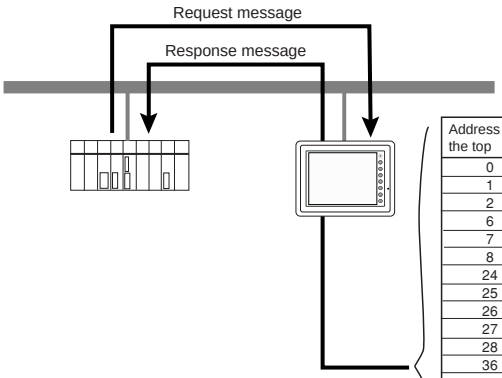


Item	Description
COMVER	1
ID	SYSPARA
REV	0
REVDATA	2000,5,30
DVCATEGORY	COMPUTER
VENDER	HAKKO-ELEC
DVMODEL	CU-03

Profile data

◇No. 7: Read communication log data

A function used to read the log data of a node communicating through the network.



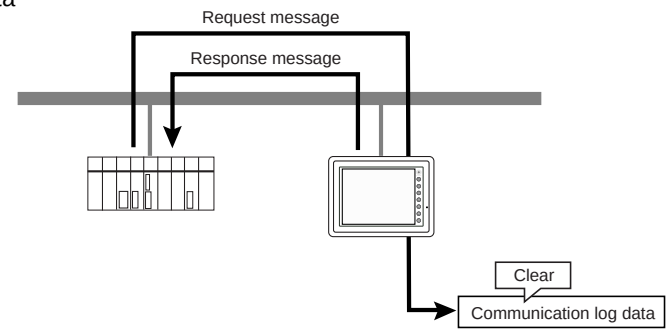
Address from the top	Description	Data validity
0	Number of times of data was sent	Valid
1	Number of data transmission errors using the socket	Valid
2	Number of data transmission errors over the Ethernet	Valid
6	Number of times of data was received	Valid
7	Number of data reception errors using the socket	Valid
8	Number of data reception errors over the Ethernet	Valid
24	Total number of errors	Valid
25	Address and size errors	Invalid
26	CBN error	Invalid
27	TBN error	Invalid
28	BSIZE error	Invalid
36	Number of transmission retries.	Valid
37	Number of times the specified number of retries was exceeded	Valid
42	Total number of data reception errors	Valid
48	Number of ACK errors.	Valid
60	Number of times a duplicate token was identified.	Valid
61	Number of tokens discarded.	Valid
62	Number of times of a token was reissued.	Valid
66	Number of times of a timeout occurred while holding a token.	Invalid
67	Number of times of a timeout occurred while monitoring	Invalid
73	Number of times a frame waiting status was requested	Valid
74	Number of times this node participated in the network.	Valid
75	Number of times this node left the network (there was no node to communicate with) due to a timeout while holding a token.)	Valid
76	Number of times this node was skipped (no token was given to this node).	Valid
77	Number of identified times that other nodes left the network.	Valid

Communication log data

◇No. 8: Clear communication log data.

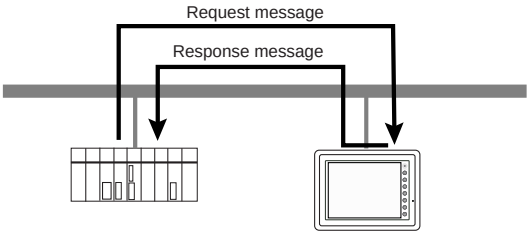
A function used through the network to clear the log data of a communicating node.

For details about the log data that will be cleared, see the table in Section 7, "Reading communication log data"



◇No. 9: Return message

This is a function used to send back a message that has been received.



11 Create screen

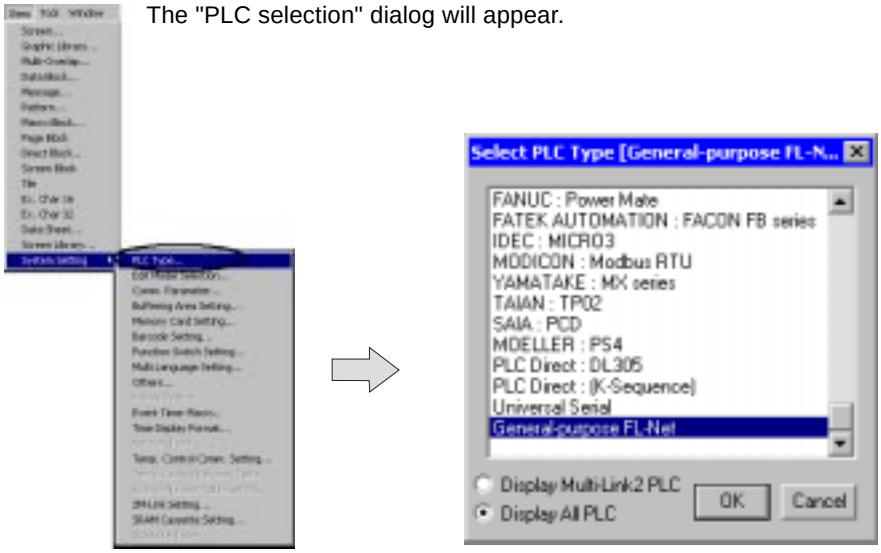
This chapter describes how to setup the ZM-71SE screen editor software for communication using an FL-net I/F module. For details about other settings and how to use them, see the instruction manual for the ZM-71SE.

Ver. 1.2.0.0 of the ZM-71SE supports FL-net functions.
The program in the ZM-80NU must be ver. 1.200 or newer.

System setting

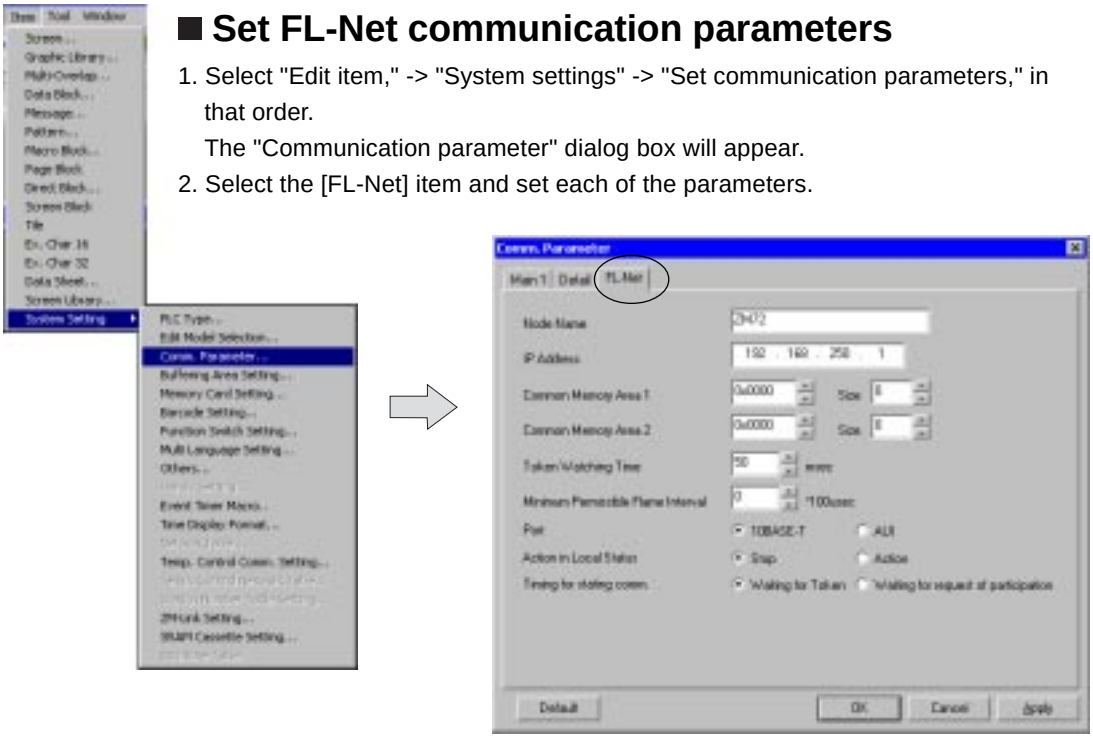
■ Select PC type

1. Select "Edit item," -> "System settings" -> "PLC type selection," in that order. The "PLC selection" dialog will appear.



2. Select "General-purpose FL-net" and click on the "OK" button.

If the same PC model is used for each node in a network, you may select "**** (FLNet)." ⇨ See page 11-6.



■ Set FL-Net communication parameters

1. Select "Edit item," -> "System settings" -> "Set communication parameters," in that order.
   The "Communication parameter" dialog box will appear.
2. Select the [FL-Net] item and set each of the parameters.

① Node name

Enter the node name for this station (ZM-43/52/72/82) using single byte characters.

② IP address

Normally, use [192.168.250.x]. The last byte (x) is the station number.
X can be any number from 1 to 254.

③ Common memory area 1

Specify the top address for this station and the size of data sending area in it.
- Top address : 0000 to 01FF(HEX)
- Size (number of words): 0 to 512(DEC)

If the same area is shared by another node, the last participating node will enter the network without a common memory area.

④ Common memory area 2

Specify the top address for this station and the size of data sending area in it.
- Top address : 0000 to 1FFF(HEX)
- Size (number of words): 0 to 8192(DEC)

If the same area is shared by another node, the last participating node will enter the network without a common memory area.

⑤ Token monitor time

Normally, this is set to [50] msec.

Enter the maximum interval after this node obtains a token until it passes it on to another node. If this node does not pass the token within this interval, the next node will issue a token. If this node does not pass the token three consecutive times, it will leave the network.

If a larger size is specified for item ③, common memory area 1, and item ④, common memory area 2, make this value larger, too.

⑥ Minimum allowable spacing between frames

Normally, enter [0] for this setting.

This is minimum distance between packets that flow over a network. It corresponds to the minimum interval between sending each token. On the FL-net, each node sends a maximum of 17K bytes of data. In this time, it divides a packet into 1K byte pieces. The interval between packets is also controlled by this setting.

Actually, the largest spacing between frames set by the participating nodes will be the one which is used. If zero is entered, the distance will vary with the capacity of each device. For example, if there is another device with a high speed processing capacity in a network, but the current node cannot process data at such a high speed, increase this distance to solve the problem. However, in this case total processing time for the network will be slower.

If there is a node that cannot communicate (participate), changing the setting may make it possible to communicate.

⑦ Port

Set the connection: [AUI] (10BASE2/10BASE5) or [10BASE-T].

⑧ Operation during local

Normally, set to [Stop].

Stop : When the ZM is a local screen, it leaves the network.

Operate: Even when the ZM is a local screen, it does not leave the network.

* When the communication parameters are changed, restart the ZM by turning the power off and then on again.

⑨ Communication start timing

Normally, set to [Wait for token].

Specify the FL-net status that the ZM will use to start data processing.

Select [Wait for participation request] only when verifying network].

Memory setting

Note: The use of the FL-net common memory function infringes on an existing patent in North America.
Therefore we will make modifications so that we will be able to use this common memory function in the next version (V2.00 planned for release in September 2002).
If you want to use this function with the FL-net version V1.00 platform, we recommend that you use Japanese version ZM-71S. Otherwise, use some other method that does not use the common memory.

This section describes the method for setting the memory in the ZM-71SE for communication on the FL-net.

1. Display the "Memory input" dialog for each area.
2. Set the common memory area.

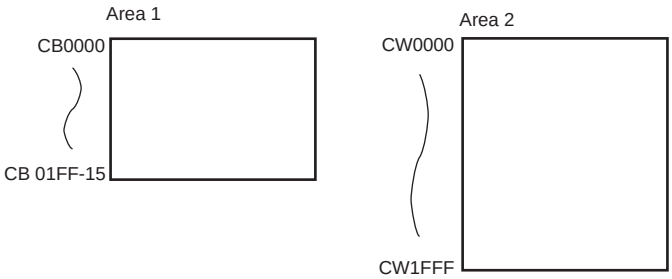
CB	Area 1. Absolute value	Cyclic transfer
CW	Area 2. Absolute value	
MB	Area 1. Incremental value	
MW	Area 2. Incremental value	
VW	Virtual memory	Message transfer

■ Common memory area (cyclic transfer)

Two methods are available for assigning access addresses to common memory areas 1 or 2 for cyclic transfers: Absolute address or incremental address.

◇ Absolute address assignment

Specify the memory area to access using an absolute value.
Enter an address as CB for Area 1 and as CW for Area 2.
[Setting range]
Area 1 (bit) : CB0000-0 to CB01FF-15
Area 2 (word): CW0000 to CW1FFF

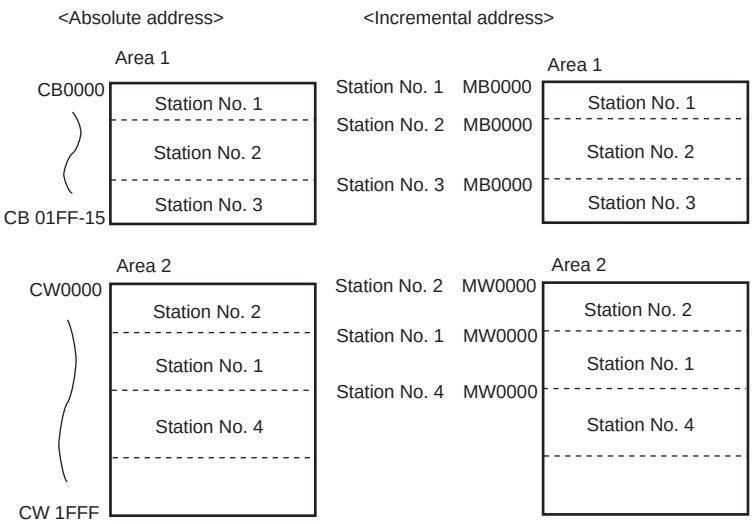


◇ Incremental address assignment

Specify a memory area using an incremental value.
Enter an address as MB for Area 1 and MW for Area 2.
As each station number is assigned starting from zero. Even when there is change in the common memory area, a change in the addresses is not required.

[Setting range]
Area 1 (bit) : MB0000-0 to MB01FF-15
Area 2 (word): MW0000 to MW1FFF

If a station number of a station not participating in the network or a memory area outside of the node area is specified, an error will be displayed.



■ Virtual memory area (message transfer)

To access the virtual memory in each node using a message transfer, use [VW]. Virtual memory varies with each node. See the individual manuals to set the address.

[Setting range]
VW00000000 to VWFFFFFFFF

The ZM-80NU does not have a virtual memory area.
- When using message transfers, the data transfer speed is slower than with cyclic transfers. Setting the VW memory on screen data may slow the refresh rate of other common memory areas.
  (However, it does not affect the network processing speed.)

Differences between "General-purpose FL-net" and "**** (FL-net)."

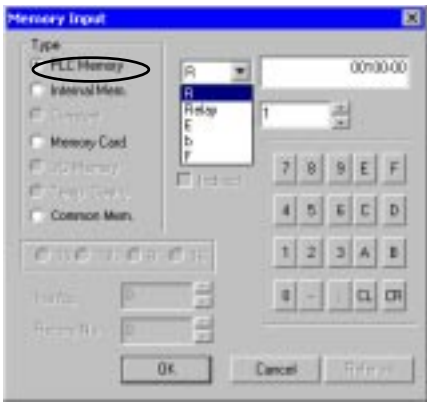
■ General-purpose FL-net

- All FL-net compatible devices can be connected in this mode.

■ **** (FL-net) [Ex.: Sharp JW (FL-net)]

- When only the same model PCs are used in a network, then message transfers are possible.
  Cyclic transfer allows communication between different models.
- Its easy to setup access to the virtual memory area. Just select "PLC memory" in the "Memory setting" dialog box.

When setting up access to virtual memory



12 Macro

This chapter describes the macro commands (GET_STATUS_FL) that can be used on the FL-net. For details about other macro commands, see the instruction manual for the ZM-71SE.

Macro command

■ [GET_STATUS_FL]

Stores various data in the system memory according to the function number set in F1.

Compatible devices

	Internal memory	PC memory	Constant	Memory card	Indirect assignment	W word	Common memory
F0	Command name						
F1	○				○		○

For details about the data stored in system memory, see Chapter 13 "System memory", in this manual.

(GET_STATUS_FL) F1

Function number (F1)	Storage data	System memory address to store the data
0	Currently specified refresh cycle time	$s646
	Currently specified minimum distance between frames	$s654
	This node's FA link status	$s627
	This node's status	$s628
	This node's FL-net status	$s629
1 to 254 Participating node data	Participating node number	$s647
	Participating node top address for Area 1	$s648
	Participating node data size for Area 1	$s649
	Participating node top address for Area 2	$s650
	Participating node data size for Area 2	$s651
	Participating node FA link status	$s652

13 System memory

The FL-net status is stored in system memory in the ZM-43/52/72/82. (Hereafter simply referred to as the ZM.)
This chapter describes the address ranges ($s620 to 654) for storing the FL-net status.
For details about the other ranges, see the instruction manual for the ZM-71SE.

* Memory type
← ZM
Type for writing data obtained from the ZM.

→ ZM
Type defined and set by the user.

List

Address	Details		* Memory type
⋮	⋮		
$s620	———————	This node's number	← ZM
621	This node's top address for Area 1		
622	This node's data size for Area 1		
623	This node's top address for Area 2		
624	This node's data size for Area 2		
625	Upper layer status		
626	———————	Protocol version	
627	———————	FA link status	
628	This node's status		
629	———————	FL-net status	
630	Participating node table		
631	Participating node table		
632	Participating node table		
633	Participating node table		
634	Participating node table		
635	Participating node table		
636	Participating node table		
637	Participating node table		
638	Participating node table		
639	Participating node table		
640	Participating node table		
641	Participating node table		
642	Participating node table		
643	Participating node table		
644	Participating node table		
645	Participating node table		
646	Refresh cycle time		

Address	Details		* Memory type
$s647	————	Participating node's number	← ZM
648	Upper layer status		
649	Participating node's top address for Area 1		
650	Participating node's data size for Area 1		
651	Participating node's top address for Area 2		
652	Participating node's data size for Area 2		
653	FA link status	————	
654	Minimum allowable frame interval		

■ Description for addresses

<This node's control table>

Address for data concerning the settings for this node.

◎ $s620

Address containing this node's station number.

◎ $s621

Contains the top address for Area 1 data which is used for sending.

◎ $s622

Contains the size of Area 1 data (in units of words) that is used as the sending area.

◎ $s623

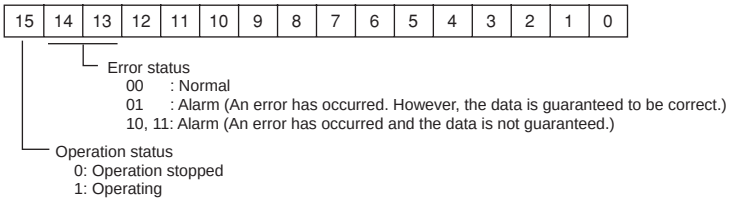
Contains the top address for Area 2 data which is used for sending.

◎ $s624

Contains the size of Area 2 data (in units of words) that is used as the sending area.

◎ $s625

Contains the status of the upper layer (ZM).


15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Error status
00 : Normal
01 : Alarm (An error has occurred. However, the data is guaranteed to be correct.)
10, 11: Alarm (An error has occurred and the data is not guaranteed.)
Operation status
0: Operation stopped
1: Operating

◎ $s626

Contains the version of the FA link protocol.

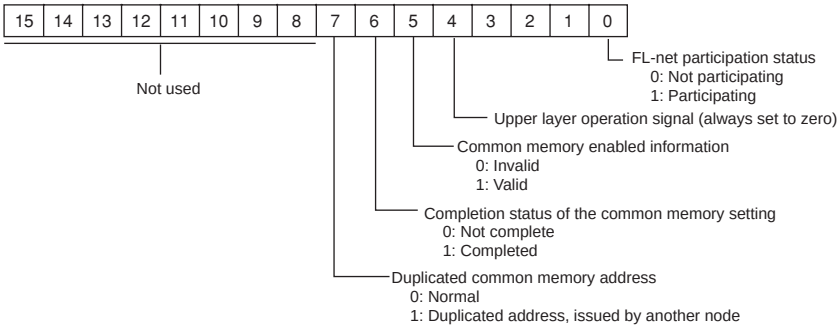
Current version is [80H].

◎ $s627

Contains FA link (network) data.

Refreshed when the [GET_STATUS_FL] macro is executed.

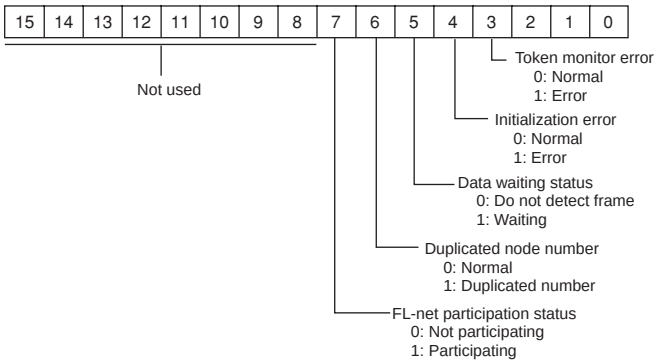
For details about the [GET_STATUS_FL] macro, see Chapter 12, "Macros", in this manual.


15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Not used
FL-net participation status
0: Not participating
1: Participating
Upper layer operation signal (always set to zero)
Common memory enabled information
0: Invalid
1: Valid
Completion status of the common memory setting
0: Not complete
1: Completed
Duplicated common memory address
0: Normal
1: Duplicated address, issued by another node

◎ $s628

Contains this node's status.

Refreshed when the [GET_STATUS_FL] macro is executed.



◎ $s629

Display in which status this node is in among steps specified by the FA link protocol.

Refreshed when the [GET_STATUS_FL] macro is executed.

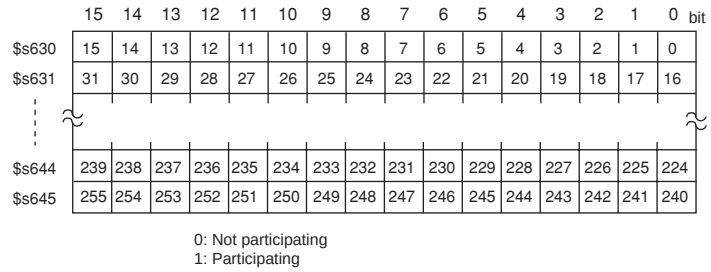
0	Wait for an initialization request
1	Participating token detection waiting time
2	Waiting for a sending or receiving trigger signal
3	Participation request received
4	In the middle of participating. Wait for three cycles.
5	In the middle of participating. Waiting for a send participation request.
6	Token waiting status
7	Token holding status

<Participating node table>

◎ $s630 to 645

Contains the participating node numbers, with one bit used for each node location.

Refreshed when the [GET_STATUS_FL] macro is executed.



	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0 bit
$s630	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
$s631	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
$s644	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
$s645	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

0: Not participating
1: Participating

For details about the [GET_STATUS_FL] macro, see Chapter 12, "Macros", in this manual.

◎ $s646

Currently specified refresh cycle time (ms)

Store interval a token goes around a network.

Refreshed when the [GET_STATUS_FL] macro is executed.

<Participating node control table>

Contains the status of nodes participating in the network.

This is information is stored by assigning a node number and executing the [GET_STATUS_FL] macro.

◎ $s647

Store the node number shown on the participating node control table.

When this value is zero, the values at addresses $s648 to 653 are ignored.

◎ $s648

Contains the upper layer status of the node number specified at address $s647. For details, see the upper layer status of each node.

◎ $s649

Contains top address for sending Area 1 that of the node number specified at address $s647.

◎ $s650

Contains the data size for sending Area 1 (in units of words) of the node number specified at address $s647.

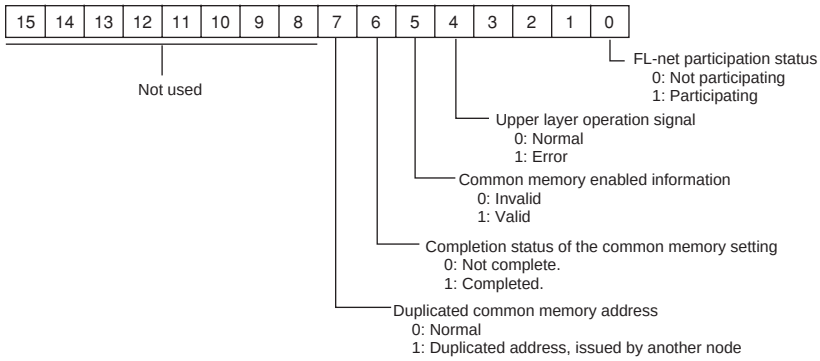
◎ $s651

Contains top address for sending Area 2 that of the node number specified at address $s647.

◎ $s652

Contains the data size for sending Area 2 (in units of words) of the node number specified at address $s647.

◎ $s653



Store FA link participation status of the node number specified at address $s647.

◎ $s654

Currently specified interval between frames. (100 μ s)
Contains the minimum packet transmission interval.
Refreshed when the [GET_STATUS_FL] macro is executed.

14 Troubleshooting

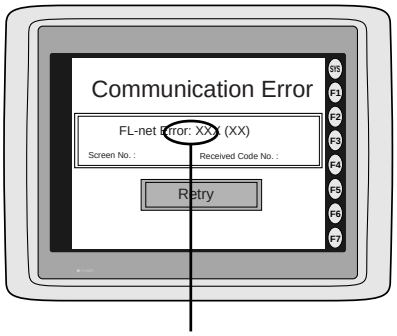
This section describes precautions concerning the FL-net, and the error messages that appear on the ZM-43/52/72/82.

General precautions related to FL-net

1	Do not place communication data from other Ethernet devices on the FL-net communication cables.
2	Do not connect the FL-net to a router.
3	Switching hubs cannot be used on the FL-net.
4	Using IR communications or other wireless media may reduce the communication speed.
5	When a personal computer is used, the communication speed may be affected by the amount of memory, the OS used, and other applications running on the personal computer.
6	Use the specified IP addresses. Network addresses should be the same. (The standard network address is 192.168.250.) The IP address node numbers (station numbers) should be within the allowable input range. Be careful not to use the same node number twice because the node numbers are not checked during the initialization check. They will be checked when communication starts. Network address: 192.168.250 — Host number (Node number): n (n: 1 to 249)
7	Connect the ground securely. Use ground lines that are large enough.
8	Separate the communication lines from any noise generating sources. Do not lay communication lines parallel to power lines.
9	When executing both cyclic data communications and message data communications at the same time, the communication speed may drop due to the volume of data.
10	Areas (common memory areas) for cyclic data communications are not required to be adjacent to each other.
11	When an SQE switch is installed on a transceiver, make sure it is properly installed according to the instruction manual.
12	Depending on the processing capacity of the connected devices, the minimum time for communication throughout the system may be affected. Set the communication processing speed for the device with the slowest communication capacity (calculated from the minimum allowable time between frames). Note that adding a single device may drop the communication speed of the whole system significantly.
13	The header section of message data communications is big endian, and the data section is little endian. However, the system parameters, that is data section at reading profile, is big endian. (Big endian is a method in which the MSB is sent first.)

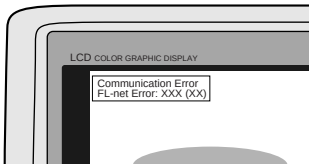
Communication errors

This section descrives communication error that may be displayed on the ZM with the FL-net communication.



The error number appears here.

- Detail about the communication errors that are displayed on the ZM main unit when using FL-net communication protocols.



Error No.	Description	Countermeasure
400	FL-net stop error Communication stopped.	Check whether the communicating station is functioning normally.
401	FL-net message error No response to a message	Set the timeout time to 100 ms or longer in the "Detailed setting" item of the "Communication parameter setting." Check whether the VW and PC memory addresses are set properly.
410	Message identification error The node you want to communicate with is not receiving the data normally.	Check whether the communicating station is responding to message communications.
421	Undefined message error The communication node has sent an unsupported message type.	Check whether the communicating station is compatible with the word read/write message communication protocol.
1201	Buffer size exceed When accessing using MB or MW, an address was specified outside the range previously set.	Check the area size for the communicating node and set then the memory.

15 Appendix

Definition of network systems

■ Communication protocol standards

The term "Communication protocol" refers to the rules for exchanging information between systems on a particular communication circuit. The communication protocols used by FL-net conform to the following standards.

FL-net supported communication protocol	Compatible specifications
FL-net	FA link protocol specification sheets (MSTC FA open promotion committee, issued by the FA control network promotion committee)
UDP	RFC768
IP, ICMP etc.	RFC791, 792, 919, 922, 950
ARP etc.	RFC826, 894
Ethernet	IEEE802.3

■ Physical implementations of FL-net

There are five physical implementations of an Ethernet network that support a 10M bps data transfer speed. They are 10BASE5, 10BASE2, 10BASE-T, 10BASE-FL, and 10BROAD36 (this is not common.) In addition to these implementations, a 100M bps Ethernet transmission speed is also available.
The FL-net supports 10BASE5 (recommended), 10BASE2, and 10BASE-T hardware.

■ IP addresses on FL-net

In order to identify one communication device among lots of devices connected to an Ethernet network, the FL-net uses IP addresses (INET address.) Therefore, each device that is connected to the network must have its own IP address.
An IP address consists of one part that identifies the network to which the device is connected, and a unique device address. Depending on the size of the network, a network can be classified as one of three classes: A, B, and C. (For special use, class D and E are also available.)

	Top octet value	Network address section	Host address section
Class A	0 to 127	xxx.xxx.xxx.xxx	Xxx.xxx.xxx.xxx
Class B	128 to 191	xxx.xxx.xxx.xxx	Xxx.xxx.xxx.xxx
Class C	192 to 223	xxx.xxx.xxx.xxx	Xxx.xxx.xxx.xxx

(Note: The gray digits are respective addresses.)

In a network, the IP address of all the communicating devices connected to this network will have the same network address. They should each have a unique device address.
The default value for the FL-net IP address is "192.168.250.N" (N is the node number: 1 to 254). The FL-net standard recommends using a class C IP address and the lower three digits of the address can be used to assign node numbers according to the FL-net protocol.

■ FL-net sub net mask

The sub net mask on an FL-net is always "255.255.255.0." The user does not need to set this sub net value.
This value is identical to the original network address section and the device address section of the class C.

■ TCP/IP, UDP/IP protocols

TCP, UDP, and IP are major protocols used on Ethernet networks.
The IP is located in the network layer of communication protocols and controls the flow of communication data.
The TCP and UDP are located in the transport layer. Both use the IP as a network layer. However, there is not much difference between these protocols in their details.
The TCP provides reliable service that does not care about the partition of data in the upper layer. On the other hand, the UDP transfers groups of data (data diagram) from the IP to the upper layer without any modification. It pays no attention to whether or not the data arrives nor does it care what the destination is. Confirmation of the data being received and re-sending the data is the job of the upper layer.
Although the UDP is not reliable, compared with the TCP, its advantage is that it has a small communication overhead.
The FL-net uses the UDP. This is because the TCP's data confirmation and re-sending procedures make it difficult to meet the FL-net goals. By omitting this procedure, the FL-net protocol layer controls data transmission correctly using tokens. And it divides and recombines multiple frames, so that it can provide high speed data exchange.

■ FL-net port number

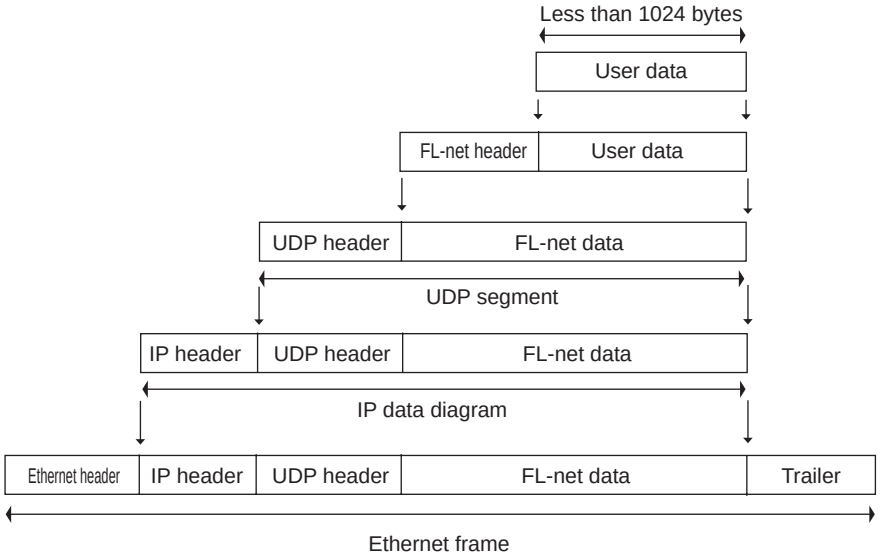
In order to offer service from the FL-net protocol layer, that is the upper position of the transport layer, the following port numbers are already specified. However, the user does not need to set the parameters for these port numbers.

	Name	Port number
1	Port number for cyclic transfer	55000 (fixed)
2	Port number for message communication	55001 (fixed)
3	Port number for a participation request frame	55002 (fixed)
4	Port number for sending data	55003 (fixed)

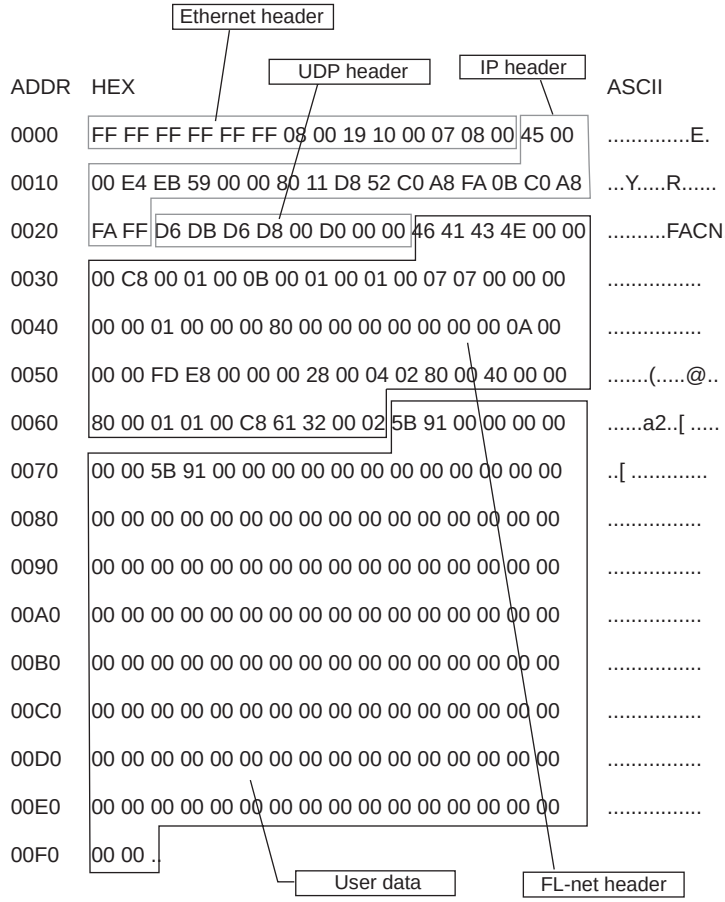
■ FL-net data format

1) Outline of the FL-net data format

Data that are sent and received over the FL-net are packed in each layer of the communication protocol as follows.

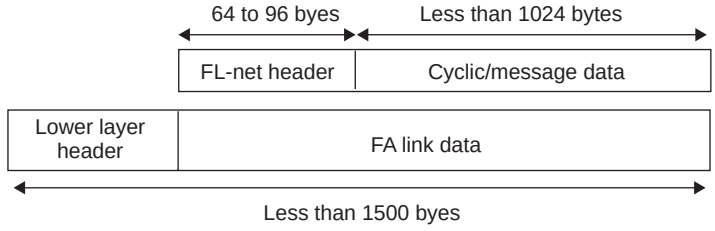


One frame of FL-net data that can be monitored in a communication circuit is shown below. In the example below, 128 bytes of cyclic data is being transferred.



2) FL-net header format

The FL-net header is 64 to 96 bytes long.



An FL-net header is added to every frame, to comply with the FL-net protocol.

Network control of FL-net

■ Token control of FL-net

1) Token

Basically, a node can send data whenever it holds a token. A node can send data without holding a token when it reissues a token due to a time out of the token monitor time, or when it issues a participation request frame so that it can begin participating in the network.

① The FA net routes one token between the nodes.

② Each node keeps the right to send data over the network from the time it receives the token until it passes the token to another node.

③ The token flows through all the nodes participating in an FL-net.

④ A token can be sent together with cyclic data.

⑤ A token can be routed without data.

⑥ Tokens are monitored by the timer. If the token is not passed along through the network for a certain interval, the network will automatically reissue a token.

⑦ If there are two tokens on the same network, the JW-50FL will unify them into one token.

2) Flow of the token

Basically, only one token exists on the same network.

If there are two or more tokens on the same network, the token from the node with the smaller node number takes priority, and the other tokens are discarded.

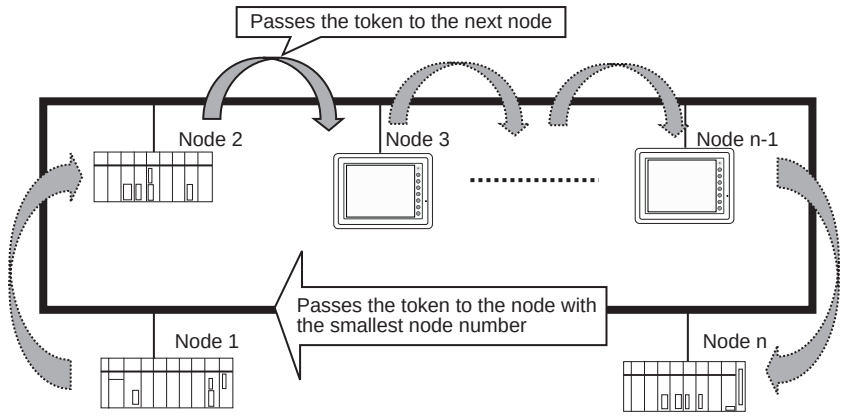
A frame with a token (a token frame) consists of a destination node number and the node number of the node sending the token.

A node will become the node holding the token when the destination node number in a token frame matches its own node number.

The routing order of a token is determined by the node numbers.

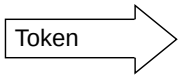
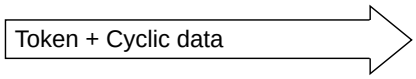
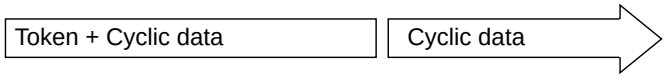
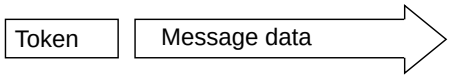
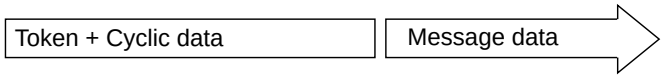
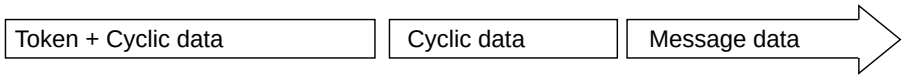
Each node passes the token in the order of the nodes listed in the participating node management table.

The node with the largest node number will pass the token to a node with the smallest node number.


Passes the token to the next node
Node 2
Node 3
Node n-1
Passes the token to the node with the smallest node number
Node 1
Node n

3) Token and data

There are six data patterns that can be attached to and sent with a token, as follows.

No.	Item	Details
1	No data to attach	Only sends the token
		
2	Cyclic data only	Only attaches cyclic data to the token
		
3	Cyclic data only, and send them by dividing.	Sends only cyclic data. The token is attached to the last frame.
		
4	Message data only	After sending the message data, passes the token along.
		
5	Cyclic data and message data	After sending the message data, sends the cyclic data together with the token.
		
6	Cyclic data and message data, and send the cyclic data by dividing.	After sending the message data, the cyclic data is sent by itself. Then the token is sent by attaching it to the last frame.
		

4) Interval between frames (minimum allowable interval between frames)

The time interval after a node receives a token until it sends a frame is referred to as the "frame interval."

The minimum interval that each node must wait for, before sending a frame, is referred to as the "minimum allowable frame interval."

The FL-net shares this minimum allowable frame interval throughout the network.

Each node calculates the maximum value of the minimum frame interval each time a node joins or leaves the participating node list.